

SERIES II

PART 1

NORTH AMERICAN FLORA



CONTENTS

TUBERALES.....	HELEN MARGARET GILKEY	1-29
BIBLIOGRAPHY.....	DONALD PHILIP ROGERS	30-34
INDEX.....		35-36

Issued 15 December 1954

Order TUBERALES *

BY HELEN MARGARET GILKEY

Mycelium either attached at one point to the ascocarp, leaving a definite tuft, or with inconspicuous attachments over the entire surface. Ascocarp well developed, generally subterranean, varying from regular to conspicuously lobed or wrinkled, from smooth to verrucose or tuberculate, and from less than one to 10 cm. or more in diameter; (a) containing a single large cavity or several to many chambers or canals opening to the surface or closed, the canals free or, if filled with a loose network of hyphae, known as *venae externae*; the ascus-bearing tissue, if vein-like, called *venae internae*; walls of the chambers and canals lined by hymenium consisting of a palisade of asci and paraphyses or of asci irregularly placed; or (b) sometimes lacking cavities, the asci appearing embedded nest-like in the tissue of the ascocarp, the nests separated by veins. Asci cylindrical or clavate to nearly spherical, 1-8-spored. Spores ellipsoid, fusiform, or globose, smooth or sculptured.

Asci forming a distinct hymenium in palisade or irregularly placed, bordering either open cavities or *venae externae*.

Hymenium in form of palisade, the paraphyses fused beyond the tips of the asci to form a secondary cortex. Fam. 1. GENEACEAE.

Hymenium irregularly arranged, or if in palisade, the paraphyses not fused to form a secondary cortex. Fam. 2. TUBERACEAE.

Asci not forming a distinct hymenium, but borne in nest-like areas separated by sterile veins. Fam. 3. TERFEZIACEAE.

* This study was made possible by grants from the American Philosophical Society, the Mycological Society of America, and the General Research Fund at Oregon State College.

Family 1. GENEACEAE

Mycelial tuft present or absent; ascocarp simple or convolute, hollow, with an apical opening or with several scattered openings. Hymenium arranged in a continuous or an interrupted palisade on inner surface of cavity, the asci cylindric or clavate, the paraphyses more or less fused above the asci to form an epithecium or secondary cortex.

Mycelial tuft present; ascocarp opening single; asci not conspicuously crowded; spores ellipsoid to rarely subglobose, never globose.

Spores smooth.

1. PETCHIOMYCES.

Spores sculptured.

2. GENEAE.

Mycelial tuft none; ascocarp openings one to several; asci generally conspicuously crowded.

Spores smooth; asci not distorted by crowding (known only in Australia).

HYDNOPLICATA.*

Spores sculptured; asci often distorted by crowding.

Ascocarp lobed, hollow, the hymenium continuous or sometimes interrupted; spores globose.

3. MYRMECOCYSTIS.

Ascocarp compact, the hymenium interrupted by sterile tissue, occurring as isolated nest-like fertile areas embedded in parenchyma; spores (in ours) ellipsoid.

4. GENABEA.

1. PETCHIOMYCES Fisch. & Matt. in E. Fisch. in E. & P.

Nat. Pfl. ed. 2. 5b⁸: 15, 40. 1938.

Ascocarp epigaeous (or hypogaeous, ours), regularly bowl-shaped, later depressed-globose or sometimes irregular, with apical opening; walls thin, with or without inward projections, the inner surface clothed with hymenium consisting of a palisade of asci and paraphyses, the latter slender, septate, forming a slight pseudoparenchymatous secondary cortex above the asci. Asci cylindric with rounded tips, 8-spored, the spores uniseriate, ellipsoid, smooth, colorless.

Type species, *Hydnocystis Thwaitesii* Berk. & Br. [*Petchiomyces Thwaitesii* (Berk. & Br.) Fisch. & Matt.].

1. *Petchiomyces kraspedostoma* Gilkey, Ore. St. Monogr.

Bot. 1: 15. 1939.

Ascocarp burnt umber (in alcohol), 1 cm. or less in diameter, hypogaeous, slightly depressed-bowl-shaped with a small nearly circular apical opening edged by stiff, incurved hairs; surface minutely verrucose; peridium pseudoparenchymatous near the outer surface, changing within to a compact structure of slender, interwoven hyphae; asci cylindric; paraphyses longer than the asci, very slender, their tips joined in slight pseudoparenchyma; spores uniseriate, short-ellipsoid, rounded at the ends, $12 \times 20 \mu$.

TYPE LOCALITY: Guadaloupe Mines, California.

HABITAT: Leaf mold.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: pl. 2, f. 42, 43.

2. GENEAE Vitt. Monogr. Tuber. 27. 1831.

Hydnocaryon Wallr. Fl. Crypt. Germ. 2: 860. 1833.

Ascocarp verrucose, brown or black, globose or irregular, with a mycelial tuft at the base and an opening at the apex, cavernous, either with a large, simple hollow or with connected

* Because of our imperfect knowledge of this group and as a convenience to future students, certain genera not known to occur in North America have been included in the keys. They are not numbered nor described.

canals formed by infolding of the walls or by inward projections, the canals converging at the apical opening; asci and paraphyses clothing the inner wall in the form of a palisade. Hymenium continuous, or sometimes interrupted by strands of sterile tissue separating it into more or less conspicuous pockets; paraphyses slender, septate, uniting beyond the asci to form a secondary pseudoparenchymatous cortex, this generally thinner than the outer cortex but similar in color and structure. Asci cylindrical or rarely slightly clavate, typically 8-spored; spores ellipsoid and papillose or verrucose, uniseriate, colored or nearly colorless.

Type species, *Genea verrucosa* Vitt.

Section 1. Eugenea (Gilkey) E. Fisch. in E. & P. Nat. Pfl. ed. 2. 5b⁸: 18. 1938. Subg. *Eugenea* Gilkey, Univ. Calif. Publ. Bot. 6: 297. 1916. Hymenium nearly continuous, rarely interrupted by strands of sterile tissue; spores ellipsoid.

Spores echinate, 36 μ or more long.	1. <i>G. echinospora</i> .
Spores papillose or verrucose; or if echinate, 28 μ or less long.	
Ascocarp hispid with long septate hairs.	2. <i>G. arenaria</i> .
Ascocarp lobed, the cavity irregular.	3. <i>G. hispidula</i> .
Ascocarp and cavity mostly simple.	4. <i>G. brachytheca</i> .
Spores generally 36 μ or more long; asci nearly as long as the paraphyses.	5. <i>G. macrosiphon</i> .
Spores generally 28 μ or less long; asci $\frac{1}{2}$ to $\frac{2}{3}$ as long as the paraphyses.	6. <i>G. compacta</i> .
Ascocarp without long septate hairs.	7. <i>G. Thaxteri</i> .
Diameter of the outer cortical cells 3 to 4 times the diameter of the spores.	
Diameter of the outer cortical cells about equaling the diameter of the spores.	
Spores 32 μ or more long.	
Spores 28 μ or less long.	

1. ***Genea echinospora*** Gilkey, Ore. St. Monogr. Bot. 1: 17. 1939.

Ascocarp mummy brown (R),* 1 cm. or less in diameter, depressed and somewhat lobed, hispid in the furrows, the surface of the lobes scabrous; cortices mostly pseudoparenchymatous, the outer portion coarse and brown with occasional long, septate hairs, the inner smaller-celled, colorless, the structure changing to prosenchyma and ultimately to separate hyphae bordering the hymenium; hymenium continuous, the asci numerous, cylindrical; spores 24–28 \times 36–40 μ , echinate, the spicules generally uniformly thickened, mostly truncate, sometimes with slight apical swellings.

TYPE LOCALITY: Cutts Island, Kittery Point, Maine.

HABITAT: "Path to the beach."

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: pl. 1, f. 12.

2. ***Genea arenaria*** Hark. Proc. Calif. Acad. III. 1: 263. 1899.

Ascocarp brown, 1–2.5 cm. in diameter, irregular, coarsely lobed and folded, verrucose, scatteringly hispid with long, brown, septate hairs; cavity of the ascocarp irregular, through infolding of the wall; outer half of the cortex pseudoparenchymatous; spores 22–24 \times 22–32 μ , covered by scattered, irregular, usually truncate papillae.

TYPE LOCALITY: California; exact locality not known.

HABITAT: "Under shrubs."

DISTRIBUTION: Oregon and California.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: pl. 1, f. 9.

3. ***Genea hispidula*** Berk. ex Tul. Fungi Hypog. 121. 1851.

Ascocarp bone brown (R), 0.5–1.5 cm. in diameter, regular or nearly so, somewhat depressed, the surface minutely verrucose and densely hispid, the long, bister (R), septate hairs obscuring the mouth of the ascocarp; cavity simple or nearly so; outer and inner cortices pseudoparenchymatous to the hymenium, the outer cells large and brown, the inner colorless;

* Color terms followed by "(R)" are used in the sense of Ridgway, *Col. Stand. & Nomencl.*

asci numerous, about $280\ \mu$ long, the paraphyses generally only slightly longer; spores $26\text{--}32 \times 32\text{--}42\ \mu$, closely covered by generally rounded papillae of varying sizes.

TYPE LOCALITY: England.

HABITAT: Mixed woods.

DISTRIBUTION: Maine, New Hampshire, Michigan; Europe.

ILLUSTRATIONS: Tul. Fungi Hypog. *pl. 12, f. 2*; *pl. 13, f. 3*; E. & P. Nat. Pfl. ed. 2. **5b**⁸: *f. 6F*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 4*.

4. *Genea brachytheca* Gilkey, Ore. St. Monogr. Bot. 1:
18. 1939.

Ascocarp bone brown (R) to nearly black, 0.5–1 cm. in diameter, globose to somewhat depressed, the surface minutely and sharply verrucose, somewhat densely hispid, the mouth of the ascocarp surrounded but not obscured by the long, brown, septate hairs; cortices pseudoparenchymatous to the hymenium, the outer cells large and brown, bearing septate hairs, the inner cells smaller, colorless; asci not crowded, about $180\ \mu$ long, the paraphyses generally exceeding them by $\frac{1}{3}$ to $\frac{1}{2}$ their length; spores irregularly arranged, conspicuously crowded in the ascus, $20\text{--}28 \times 24\text{--}32\ \mu$, covered by generally pointed or truncate papillae of varying sizes.

TYPE LOCALITY: Lower St. Lawrence, Quebec.

HABITAT: Bog.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Ore. St. Monogr. Bot. 1: *pl. 1, f. 1, 2*.

5. *Genea macrosiphon* Gilkey, Ore. St. Monogr. Bot. 1:
18. 1939.

Ascocarp buffy citrine (R), 1 cm. or less in diameter, nearly regular with occasional infolding of the wall; both outer and inner surfaces minutely verrucose; cavity of the ascocarp simple, with no projections except those following the occasional folds of the wall; outer layer of both cortices coarsely pseudoparenchymatous, the largest cells 3–4 times the spore diameter, the pseudoparenchyma changing abruptly below the verrucae to a loose hyphal structure bordering the hymenium; hymenium principally continuous; asci many; spores $24 \times 28\text{--}32\ \mu$, covered by scattered mostly rounded-conical, large and small papillae.

TYPE LOCALITY: Lower St. Lawrence, Quebec.

HABITAT: Bog.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl. 1, f. 10*.

6. *Genea compacta* Hark. Proc. Calif. Acad. III. 1:
262. 1899.

Ascocarp light brown, reaching 1 cm. in diameter, lobed, coarsely verrucose; outer cells of the cortices thick-walled, often projecting and pointed; cortical structure pseudoparenchymatous through verrucae, changing abruptly to separate hyphae; spores $24\text{--}28 \times 32\text{--}34\ \mu$, the surface covered by large irregular somewhat crowded truncate or conical papillae; paraphyses very slender, conspicuously longer than the asci.

TYPE LOCALITY: Mt. Tamalpais, California.

HABITAT: Forest.

DISTRIBUTION: California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl. 43, f. 10*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 8*.

7. *Genea Thaxteri* Gilkey, Ore. St. Monogr. Bot. 1:
19. 1939.

Ascocarp Sudan brown (R), 1 cm. or less in diameter, slightly or not at all lobed, the surface verrucose, the projections low; cavity of the ascocarp nearly simple; cortices pseudo-

parenchymatous nearly throughout; asci conspicuously shorter than the paraphyses; spores not crowded in the ascus, $20-22 \times 26-28 \mu$, covered by crowded, mostly rounded or somewhat pointed papillae.

TYPE LOCALITY: Cutts Island, Kittery Point, Maine.

HABITAT: "Path near house."

DISTRIBUTION: Maine and Tennessee.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl. 1, f. 3.*

Section 2. *Heterogenea* (Gilkey) E. Fisch. in E. & P. Nat. Pfl. ed. 2. 5b^s: 18. 1938.
Subg. *Heterogenea* Gilkey, Univ. Calif. Publ. Bot. 6: 297. 1916. Hymenium interrupted by strands of sterile tissue; spores subglobose.

Spores $27 \times 28 \mu$ or less, minutely verrucose.

8. *G. Harknessii*.

Spores $28 \times 32 \mu$ or more, coarsely papillose.

9. *G. Gardneri*.

8. ***Genea Harknessii* Gilkey, Univ. Calif. Publ. Bot. 6:
300. 1916.**

Ascocarp dark brown to black, 2 cm. or less in diameter, somewhat lobed, verrucose; cavity of the ascocarp greatly modified by irregular projections from the wall; cortices pseudoparenchymatous, with dark, thick-walled cells through the verrucae, changing inward to tangled hyphae; hymenium often double through coalescence of the inward projections, divided by sterile strands connecting the outer and inner cortices into sometimes distinct fertile pockets; asci cylindric to slightly clavate, loosely enclosing the spores; spores uniseriate or incompletely 2-seriate, nearly globose, $22-27 \times 24-28 \mu$, rarely larger, the surface covered by variable semi-globose or truncate verrucae.

TYPE LOCALITY: Berkeley, California.

HABITAT: Leaf mold under trees and shrubs.

DISTRIBUTION: Washington, Oregon, and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 29, f. 10-13*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 6.*

9. ***Genea Gardneri* Gilkey, Univ. Calif. Publ. Bot. 6:
301. 1916.**

Ascocarp black, 1-1.5 cm. in diameter, much wrinkled and folded, the surface minutely verrucose; cavity of the ascocarp very irregular from infolding of the wall but rarely from inward projections; outer layer of both cortices pseudoparenchymatous, with large, dark, thick-walled cells, these becoming small, thin-walled, and colorless inward, gradually changing to prosenchyma; hymenium sometimes divided by sterile strands into pockets; spores uniseriate or rarely incompletely 2-seriate, sometimes few maturing in an ascus, $28-34 \times 32-36 \mu$, papillose, the papillae large, crowded, low, generally semiglobose.

TYPE LOCALITY: Oakland, California.

HABITAT: Under oaks.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 28, f. 7, 8*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 11.*

3. **MYRMECOCYSTIS Hark. Proc. Calif. Acad. III. 1:
269. 1899.**

Pseudogenea Bucholtz in Matt. Malpighia 14: 250. 1901.

Genea subg. *Myrmecocystis* Gilkey, Univ. Calif. Publ. Bot. 6: 297. 1916.

Ascocarp white or purple, verrucose, nearly even with a single opening, to complexly convolute with several openings; mycelial tuft none. Hymenium continuous or interrupted. Asci numerous, crowded, the paraphyses appearing fascicled among them; spores globose.

Type species, *Myrmecocystis cerebriformis* Hark.

Hymenium principally continuous; spores irregularly papillose.

1. *M. compacta*.

Hymenium interrupted; spores minutely soft-spinose.

2. *M. cerebriformis*.

1. *Myrmecocystis compacta* (Hark.) Gilkey, comb. nov.

Hydnocystis compacta Hark. Proc. Calif. Acad. III. 1: 262. 1899.
Genea intermedia Gilkey, Univ. Calif. Publ. Bot. 6: 303. 1916.

Ascocarp vinaceous-purple (R), 1–2 cm. in diameter, the inner wall seashell pink (R) to whitish, less verrucose than the outer; cortices coarsely pseudoparenchymatous throughout; hymenium nearly continuous; spores uniseriate, 36–40 μ , smooth and hyaline when young, irregularly covered at maturity by semiglobose papillae varying in size on a single spore from 5 μ in height to minute granules often coalescing in irregular groups; paraphyses crowded among the asci, enlarging and coalescing beyond the asci to form a secondary cortex, and apparently again emerging as free tips at the surface of the ascocarp cavity.

TYPE LOCALITY: Placer County, California.

HABITAT: Leaf mold.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl.* 43, *f.* 10; Univ. Calif. Publ. Bot. 6: *pl.* 29, *f.* 14; Ore. St. Monogr. Bot. 1: *pl.* 1, *f.* 5; Mycologia 47 (in press).

2. *Myrmecocystis cerebriformis* Hark. Proc. Calif. Acad.

III. 1: 269. 1899.

Myrmecocystis candida Hark. Proc. Calif. Acad. III. 1: 269. 1899.
Pseudogenea californica E. Fisch. Ber. Deutsch. Bot. Ges. 25: 372. 1907.
Genea cerebriformis Gilkey, Univ. Calif. Publ. Bot. 6: 304. 1916.

Ascocarp creamy-white, 0.5–2 cm. in diameter, conspicuously convolute with generally several openings; inner surface less verrucose than the outer; cavity of the ascocarp, by infoldings of and projections from the walls, becoming a system of labyrinthine canals; cortices principally pseudoparenchymatous, the cells becoming smaller within, changing to prosenchyma toward the hymenium; hymenium sometimes double, partitioned into mostly curved large pockets; asci crowded, more or less deformed by pressure, cylindrical to somewhat clavate, normally 8-spored but often some spores not maturing; spores 1- or incompletely 2-seriate, 28–44 μ , smooth and hyaline when young, becoming smoky-yellow at maturity and densely covered by long, soft spines, these often coalescing in groups, making the spore surface appear irregularly rugose; paraphyses fascicled among the densely crowded asci.

TYPE LOCALITY: Placer County, California.

HABITAT: Leaf mold, deciduous or coniferous woods.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl.* 45, *f.* 28, 29; E. & P. Nat. Pfl. ed. 2. 5b⁸: *f.* 7B, C; Ore. St. Monogr. Bot. 1: *pl.* 1, *f.* 7.

4. *GENABEA* Tul. Gior. Bot. Ital. 2: 60. 1845.

Ascocarp compact, without mycelial tuft, irregularly convolute. Hymenium consisting of crowded asci and fascicled paraphyses interrupted by a pseudoparenchymatous sterile structure, resulting in the appearance of hymenial "nests" embedded in pseudoparenchyma; asci long, deformed by crowding, 4–8-spored; spores ellipsoid (ours) to globose, smooth and hyaline when young, sharply or bluntly spinose at maturity.

Type species, *G. fragilis* Tul.

1. *Genabea fragilis* Tul. Gior. Bot. Ital. I. 2: 60. 1845.

Ascocarp black, reaching 2 cm. in diameter, conspicuously convolute; asci more or less clavate; spores ellipsoid, minutely spinose, 22–28 \times 28–38 μ .

TYPE LOCALITY: France.

HABITAT: In ground beneath trees.

DISTRIBUTION: Quebec; France.

ILLUSTRATIONS: Tul. Fungi Hypog. *pl.* 8, *f.* 3; *pl.* 16, *f.* 2; E. & P. Nat. Pfl. 1¹: *f.* 225 E-H; ed. 2. 5b⁸: *f.* 8; Ore. St. Monogr. Bot. 1: *pl.* 1, *f.* 13, 48.

Family 2. TUBERACEAE

Ascocarp containing one to several empty or hypha-filled chambers or canals. Hymenium either in palisade or as irregularly placed asci lining the walls of cavities or surrounding the venae externae.

Hymenium consisting of asci and paraphyses in palisade, lining the walls of cavities.

- Ascocarp cavities empty.
- Ascocarp cavity simple and single.
 - Spores smooth. 1. HYDNOCYSTIS.
 - Spores sculptured. 2. HYDNOTRYA.
- Ascocarp partitioned into canals or chambers.
 - Openings to the surface none.
 - Spores smooth; paraphyses equaling the asci. 3. GEOPORA.
 - Spores sculptured; paraphyses one-third as long as the asci (known only from Java and Australia). LABYRINTHOMYCES.
 - Openings to the surface one or several.
 - Ascocarp stipitate; fertile portion containing a few large chambers. 4. CAULOCARPA.
 - Ascocarp not stipitate.
 - Spores smooth.
 - Canals converging at one conspicuous opening; spores ellipsoid. 5. BARSSIA.
 - Canals not converging; spores globose (known only from Japan). PHYMATOMYCES.
 - Spores sculptured. 2. HYDNOTRYA.
- Ascocarp cavities filled with hyphae, these sometimes breaking raggedly at maturity.
 - Cavities all opening at one end of the ascocarp.
 - Spores smooth (unknown in America). STEPHENSIA.
 - Spores sculptured. 6. PACHYPHLOEUS.
 - Cavities not converging, forming canals or chambers generally opening at several points on the surface.
 - Cavities clearly opening at the surface, sterile except at the dilated blind endings. 7. PIERSONIA.
 - Surface openings sometimes obscure, the cavities fertile their entire length.
 - Spores smooth. 8. DENSOCARPA.
 - Spores sculptured. 9. CHOIROMYCES.
- Hymenium not in palisade; or if present, the palisade consisting of paraphyses only, the asci irregularly arranged.
 - Cavities empty or nearly so.
 - Cavities not opening to the surface; spores smooth. 10. BALSAMIA.
 - Cavities opening to the surface; spores sculptured. 11. HYDNOBOLITES.
 - Cavities filled with hyphae, forming venae externae (absent in *Paradoxa?*). 12. PSEUDOBALSAMIA.
 - Spores smooth.
 - Spores sculptured.
 - Spore number variable in the asci of a single ascocarp.
 - Venae internae present, generally distinct; spores alveolate or spinose. 13. TUBER.
 - Venae internae absent or obscure.
 - Spores irregularly papillose (unknown in America). FISCHERULA.
 - Spores spinose-reticulate. 14. LESPIAULTINIA.
 - Spores generally one to an ascus; venae externae apparently absent (unknown in America). PARADOXA.

1. *Hydnocystis* Tul. Gior. Bot. Ital. I. 2: 59. 1845.

Ascocarp regular or somewhat lobed, hollow, subglobose, with or without an external opening to the hymenium, the opening when present often more or less closed by dense hairs; surface verrucose, tomentose; ascocarp wall partially or wholly pseudoparenchymatous. Cavity lined with hymenium consisting of asci and paraphyses in palisade. Asci cylindrical to long-clavate, rounded at the ends; paraphyses slender, the length of the asci or projecting beyond them into the interior of the ascocarp; spores globose to globose-ellipsoid, smooth, colorless, or of a very pale color.

Type species, *H. piligera* Tul.

1. *Hydnocystis californica* Gilkey, Univ. Calif. Publ. Bot. 6: 289. 1916.

Ascocarp about 1 cm. in diameter, subglobose, pale to very dark brown, completely closed, enveloped by the dark brown tomentum of the septate, branched hyphae; surface divided into

mostly hexagonal areas 1.5 mm. in diameter, forming the bases of the pyramidal projections; gleba white; structure pseudoparenchymatous through verrucae, the cells 12–16 μ in diameter, the walls of the outer cells slightly thickened, occasional outer cells prolonged into septate hairs; pseudoparenchyma changing within to hyphae of the same diameter as that of the outer cells, these becoming much narrower toward the hymenium; the latter lining the cavity of the ascocarp in regular palisade of asci and paraphyses; asci 16–24 \times 240 μ , cylindric, narrowing to a more or less definite stipe; spores globose-ellipsoid, smooth, 12–20 \times 22–24 μ , uniseriate; paraphyses slender, 4–6 μ thick, generally the length of the asci but some projecting beyond at irregular distances, barely swollen at the tips.

TYPE LOCALITY: San Francisco County, California.

HABITAT: Leaf mold.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 29, f. 9*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 29*.

2. *HYDNOTRYA* Berk. & Br. Ann. Mag. Nat. Hist. 18: 78. 1846.

Ascocarp subglobose, the wall simple or generally folded, or with projections into the interior; gleba cavernous or penetrated by hollow chambers or labyrinthine canals opening to the surface at one point or several, usually between folds. Chambers and canals lined by hymenium. Asci forming a palisade with the paraphyses; additional scattered asci sometimes embedded in the subhymenial structure; asci cylindric, clavate, or long-ovoid, 6–8-spored; spores globose or ellipsoid, minutely or coarsely sculptured; paraphyses more or less swollen at the tips, at the external openings of the chambers continuing to the surface of the ascocarp as swollen-tipped villi.

Type species, *Hydnotrya Tulasnei* Berk. & Br.

Spores globose.

Spore surface minutely papillose.

Spore covered by a few coarse protuberances.

Spores more or less elongated, not globose.

Spores not exceeding 20 μ in length, generally much shorter.

Spores 30 μ or more in length.

Spores regularly ellipsoid.

Spore surface papillose.

Spore surface lacunose-rugose.

Spores often appearing cubical; surface irregularly thickened.

1. *H. cerebriformis*.

2. *H. Tulasnei*.

3. *H. ellipsospora*.

4. *H. yukonensis*.

5. *H. varitiformis*.

6. *H. cubispora*.

1. *Hydnotrya cerebriformis* Hark. Proc. Calif. Acad. III. 1: 266. 1899.

Ascocarp salmon-color, reaching 2.5 cm. in diameter, subglobose, coarsely lobed, with several deep, close folds; surface minutely villose; gleba white or yellowish, penetrated by long labyrinthine, branching, narrow canals, the walls lined by hymenium; canals hollow but often so narrow that the tips of opposite paraphyses come in contact; asci cylindric, 8-spored, 28–32 \times 220 μ ; spores brown, globose, 25–32 μ , minutely papillose.

TYPE LOCALITY: Nevada County, California.

HABITAT: Leaf mold.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl. 44, f. 19*; Univ. Calif. Publ. Bot. 6: *pl. 30, f. 27*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 19*.

2. *Hydnotrya Tulasnei* Berk. & Br. Ann. Mag. Nat. Hist. 18: 78. 1846.

Ascocarp brown, more or less convolute, 1–4 cm. in diameter; gleba consisting of anastomosing folds forming canals and chambers; asci clavate to cylindric; subhymenial asci few to many; spores uniseriate to irregularly arranged, 30–44 μ in diameter, irregularly globose, coarsely papillose or lobed; paraphyses somewhat swollen at the tips.

TYPE LOCALITY: Spye Park, England.
 HABITAT: Under trees.
 DISTRIBUTION: Maine, Pennsylvania, Michigan; Europe.
 ILLUSTRATIONS: Tul. Fungi Hypog. *pl. 8, f. 2; pl. 14, f. 3; pl. 21, f. 14*; Corda Ic. Fung. 6: *pl. 15, f. 116*; E. & P. Nat. Pfl. ed. 2. 5b⁸: *f. 10*.

3. *Hydnotrya ellipsospora* Gilkey, Univ. Calif. Publ. Bot. 6: 307. 1916.

Ascocarp purplish-brown, 1–9 cm. in diameter, subglobose, varying from a simple structure consisting of loose folds casually joined to a compact, complicated arrangement of folds and projections separating numerous canals and chambers; surface of the ascocarp minutely villose; spores ellipsoid, $10 \times 14 \mu$, minutely papillose, 8 to each cylindrical ascus; paraphyses scarcely swollen at the apex, not longer than the asci.

TYPE LOCALITY: Pacific Grove, California.
 HABITAT: Under shrubs and trees.
 DISTRIBUTION: Oregon and California.
 ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 30, f. 38*; Ore. St. Monogr. Bot. 1: *pl. 1, f. 20*.

4. *Hydnotrya yukonensis* Gilkey, Mycologia 39: 445. 1947.

Ascocarp wood brown (R), convolute, reaching 2.5 cm. in diameter; gleba compact, penetrated by narrow canals and chambers; cortex coarsely pseudoparenchymatous, changing to prosenchyma and loose, branching hyphae; superficial cells forming septate hairs; subhymenial asci occasionally present; asci 240–280 μ in length, cylindrical at maturity, sometimes slightly clavate at first; paraphyses longer than the asci, scarcely swollen at the apex; spores ellipsoid, uniseriate, pale yellow-brown, $28 \times 32\text{--}36 \mu$, papillose.

TYPE LOCALITY: Near Dawson, Canada.
 HABITAT: "In black soil under moss."
 DISTRIBUTION: Known only from the type locality.
 ILLUSTRATIONS: Mycologia 39: 443, *f. 12, 13*.

5. *Hydnotrya variiformis* Gilkey, Mycologia 39: 444. 1947.

Ascocarp cinnamon-buff (R) to cream-buff (R), somewhat paler within, more or less globose to somewhat depressed, simple with a single opening to complexly convolute and internally divided into many cavities with several openings; cortex pseudoparenchymatous without, changing to compact, branching hyphae; asci 240–280 μ long, somewhat clavate at first, becoming cylindrical; paraphyses longer than the asci, slightly enlarged at the apex; spores uniseriate at maturity, ellipsoid, $24\text{--}28 \times 32\text{--}36 \mu$, yellow-brown, minutely and irregularly lacunose-rugose.

TYPE LOCALITY: Mt. Shasta, California.
 HABITAT: Coniferous woods.
 DISTRIBUTION: Wyoming, Oregon, and California.
 ILLUSTRATIONS: Mycologia 39: 443, *f. 5–11*.

6. *Hydnotrya cubispora* (Bess. & Thomps.) Gilkey, Ore. St. Monogr. Bot. 1: 23. 1939.

Genea cubispora Bess. & Thomps. Mycologia 12: 284. 1920.

Ascocarp pale pinkish buff (R) or pinkish cinnamon (R) to isabella color (R), 0.5–2 cm. in diameter, somewhat lobed and folded, with typically a single opening, rarely more, the outer surface minutely villose, the cavity generally simple but somewhat irregular from the surface lobing; peridium 240–500 μ thick, the outer layer of pseudoparenchyma changing within to prosenchyma and tangled hyphae; mature asci cylindrical, conspicuously of greater diameter than the basal hyphae, narrowed and truncate at the apex, subhymenial asci none or rare; spores uniseriate, brown, so crowded when young as to appear cubical, many retaining the cubical shape at maturity, the terminal spore generally conspicuously elongated, the epispore irregularly

thickened; spore diameter 30–60 μ , the terminal spore occasionally reaching 90 μ ; paraphyses filiform, exceeding the asci by 100–120 μ , parallel, somewhat swollen.

TYPE LOCALITY: Gogebic County, Michigan.

HABITAT: Sandy soil and leaf mold, mixed woods.

DISTRIBUTION: Nova Scotia, New Brunswick, Maine, Michigan, Tennessee, Alaska, and Oregon.

ILLUSTRATIONS: Mycologia 12: *pl.* 20; Ore. St. Monogr. Bot. 1: *pl.* 1, *f.* 16–18.

3. *GEOPORA* Hark. Bull. Calif. Acad. 1: 168. 1885.

Pseudohydnotrya E. Fisch. in E. & P. Nat. Pfl. 1: 282. 1896.

Ascocarp coarsely dark-tomentose, irregular, varying from simply lobed to complexly convolute, the folds readily separable or more or less united; inner cavity single but divided into canals and chambers by infolding of the wall and projections from its surface, or becoming many by fusions of folds and projections. Walls of cavities lined by hymenium in palisade. Asci cylindrical to clavate; spores ellipsoid, smooth, colorless, uniseriate or incompletely biseriate; paraphyses slightly swollen at the apex.

Type species, *Geopora Cooperi* Hark.

Spores ellipsoid, 10–16 \times 18–24 μ .

Spores globose-ellipsoid, 17–24 \times 20–28 μ .

1. *G. Cooperi*.

2. *G. magnata*.

1. *Geopora Cooperi* Hark. Bull. Calif. Acad. 1: 168. 1885.

Pseudohydnotrya Harknessii E. Fisch. in E. & P. Nat. Pfl. 1: 282. 1896.

Pseudohydnotrya carnea Hark. Proc. Calif. Acad. III. 1: 267. 1899.

Pseudohydnotrya nigra Hark. Proc. Calif. Acad. III. 1: 267. 1899.

Geopora Harknessii E. Fisch. ex Gilkey, Univ. Calif. Publ. Bot. 6: 330. 1916.

Geopora magnifica Gilkey, Univ. Calif. Publ. Bot. 6: 334. 1916.

Geopora annulata Gilkey, Univ. Calif. Publ. Bot. 6: 335. 1916.

Ascocarp 0.5–10 cm. in diameter, pale to dark brown, more or less verrucose, coarsely brown-tomentose, slightly lobed to strongly convolute, the tomentum continuing inward on the infolded surface; interior chamber comparatively simple to exceedingly irregular, and consisting of long, labyrinthine canals resulting from folds and projections, these generally readily separable but sometimes connected and so closely crowded that the tips of two layers of paraphyses meet; external wall and folds more or less pseudoparenchymatous between the hymenium and the surface tomentum; outer cells of the cortex colored and larger than the inner colorless cells; asci cylindrical to somewhat clavate, rounded or somewhat pointed at the apex, 16–28 \times 140–200 μ ; spores mostly uniseriate, ellipsoid to long-ellipsoid, 10–16 \times 18–24 μ ; paraphyses 2–8 μ thick, little longer than the asci.

TYPE LOCALITY: Haywards, California.

HABITAT: Under trees.

DISTRIBUTION: Michigan, Idaho, Oregon, California; northern Europe.

ILLUSTRATIONS: E. & P. Nat. Pfl. 1: *f.* 205 A, B; Bull. Calif. Acad. III. 1: *pl.* 43, *f.* 16; Bot. Zeit. 66: *pl.* 6, *f.* 14, 16; Univ. Calif. Publ. Bot. 6: *pl.* 28, *f.* 6; *pl.* 30, *f.* 22, 35, 37; Ore. St. Monogr. Bot. 1: *pl.* 2, *f.* 41, 42.

2. *Geopora magnata* Hark. Proc. Calif. Acad. III. 1: 270. 1899.

Ascocarp dark brown, 1.5 cm. in diameter, somewhat lobed; surface verrucose, clothed with tangled, coarse, dark brown hairs; cortex pseudoparenchymatous, the outer cells large with slightly thickened walls, the inner cells elongated toward the center, changing abruptly to a hyphal structure; cavity of the ascocarp partitioned by large, loose, mostly separable folds, also by projections from the walls, into connected labyrinthine canals, the tomentum of the surface and the pseudoparenchyma of the cortex running through the center of the folds; asci 24–28 \times 200–220 μ , cylindrical to somewhat clavate, rounded at the apex, gradually tapering at the base to a long stipe; spores globose-ellipsoid, 17–24 \times 20–28 μ ; paraphyses 5–8 μ thick, about equal in length to the asci.

TYPE LOCALITY: Golden Gate Park, San Francisco, California.

HABITAT: Under pine.

DISTRIBUTION: California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl. 45, f. 34*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 40*.

4. CAULOCARPA Gilkey, Mycologia 39: 441. 1947.

Ascocarp fleshy, stipitate, slightly lobed, internally separated by partitions into hollow hymenium-lined chambers opening to the surface at furrows between the lobes. Asci long, slender, 8-spored; paraphyses equaling the asci, narrow, septate, not swollen at the apex; spores uniseriate, small, ellipsoid, smooth.

Type species, *Caulocarpa montana* Gilkey.

1. *Caulocarpa montana* Gilkey, Mycologia 39: 442. 1947.

Ascocarp Dresden brown (R), fleshy, nearly globose or slightly flattened vertically, 2–3.7 cm. in diameter, nearly regular but with a few thick lobes above, narrowed abruptly at the base into a stipe 1 cm. or more long; interior partially or completely partitioned into large, empty chambers lined by dense hymenial palisade; cortex compactly prosenchymatous; subcortex and partitions of irregular, loosely interwoven hyphae; asci 10–12 × 320 μ; paraphyses very slender, acute; spores ellipsoid to oblong with rounded ends, smooth at least at first, 10–17 μ, colorless, generally occupying the apical one-third to one-half of the ascus.

TYPE LOCALITY: Hat Point, Wallowa County, Oregon, alt. 7000 ft.

HABITAT: Under duff of coniferous grove.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Mycologia 39: 443, *f. 1–4*.

5. BARSSIA Gilkey, Mycologia 17: 253. 1925.

Ascocarp scabrous to verrucose, even or lobed, with an irregular generally apical depression. Inner tissue of the ascocarp thrown up into more or less connected folds forming hymenium-lined canals and chambers opening into the depression. Asci cylindrical to slightly clavate, 8-spored; paraphyses slender, longer than the asci; spores ellipsoid, smooth, uniseriate or incompletely biseriate, colorless.

Type species, *Barssia oregonensis* Gilkey.

1. *Barssia oregonensis* Gilkey, Mycologia 17: 254. 1925.

Ascocarp light ochraceous-buff (R) to orange-cinnamon (R), 1–2.5 cm. in diameter, somewhat lobed, slightly flattened, the depression forming an irregular cavity within the ascocarp; canals and chambers lined by the felt-like hymenium; asci mostly cylindrical, often curved, 20–30 × 120 μ; paraphyses slender, not swollen at the tips, extending 40–50 μ beyond the asci; spores smooth, hyaline, ellipsoid, 12–17 × 26–32 μ, uniseriate or incompletely biseriate.

TYPE LOCALITY: Sulphur Springs Road, Benton County, Oregon.

HABITAT: Mixed woods.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Mycologia 17: *pl. 26, f. 5, 6*; Ore. St. Monogr. Bot. 1: *pl. 3, f. 49, 50*.

6. PACHYPHLOEUS Tul. Gior. Bot. Ital. I. 2: 60. 1845.

Ascocarp orange, yellow, or green, with a conspicuous basal mycelial tuft; cortex pseudo-parenchymatous; venae internae originating from the subcortical structure, either at the base of the ascocarp and extending to various points of the upper side or (in ours) at different points of the periphery and converging at the apex; venae externae opening at various points of the upper side of the ascocarp or (in ours) at a single point in a depression at the apex. Venae externae lined by hymenium in irregular palisade. Asci cylindrical or clavate to nearly globose, 8-spored; spores globose, acutely or obtusely spinose, uniseriate or irregularly arranged in the ascus.

Type species, *Choironomyces melanoxanthus* Berk. [*Pachyphloeus melanoxanthus* (Berk.) Tul.].

Ascocarp orange to brown; asci cylindric or nearly so.

1. *P. citrinus*.

Ascocarp greenish; asci broader.

Asci nearly globose; ascocarp surface dull green; gleba yellow.

2. *P. virescens*.

Asci longer; ascocarp surface greenish-black; gleba black, marbled by yellow or green.

3. *P. melanoxanthus*.

1. *Pachyphloeus citrinus* Berk. & Br. Ann. Mag. Nat. Hist. 18: 79. 1846.

Pachyphloeus carneus Hark. Proc. Calif. Acad. III. 1: 268. 1899.

Choironomyces gangliiformis sensu Hark. Proc. Calif. Acad. III. 1: 277. 1899. Non *C. gangliiformis* Vitt. 1831.

Ascocarp coarsely verrucose, bright orange to brown, 1–3 cm. in diameter, somewhat compressed, even, with a large, round opening at the apex; venae internae originating at various points of the periphery and converging at the apical mouth; cortex pseudoparenchymatous through verrucae of the surface; subcortex mostly hyphal; asci narrowly club-shaped to very broad, 32–36 × 60–160 μ; spores generally irregularly arranged, rarely uni- or biseriolate, globose, 13–22 μ; sculpturing somewhat variable, generally consisting of low, comparatively broad, truncate papillae thickened at the tips; an occasional spore with projections more or less needle-like; paraphyses 8–13 μ thick, rounded and somewhat swollen at the ends, usually exceeding the asci.

TYPE LOCALITY: England

HABITAT: In woods.

DISTRIBUTION: Maine, Virginia, Ohio, Tennessee, California; Europe.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: pl. 45, f. 33; Univ. Calif. Publ. Bot. 6: pl. 30, f. 24; Ore. St. Monogr. Bot. 1: pl. 1, f. 26.

2. *Pachyphloeus virescens* Gilkey, Ore. St. Monogr. Bot. 1: 31. 1939.

Ascocarp surface dull green, 1 cm. or less in diameter, somewhat coarsely and irregularly verrucose; gleba livid yellow; asci nearly globose to broadly obovoid or rarely broadly clavate, 68–80 μ, generally abruptly short-stipitate, the stipe 12–16 μ long; spores 18–24 μ, covered by short truncate papillae more or less thickened at the apices.

TYPE LOCALITY: Los Gatos, California.

HABITAT: Not indicated.

DISTRIBUTION: Nebraska and California.

ILLUSTRATIONS: Ore. St. Monogr. Bot. 1: pl. 1, f. 24, 25.

3. *Pachyphloeus melanoxanthus* (Tul. ex Berk.) Tul. Gior. Bot. Ital. I. 2: 61. 1845.

Choironomyces melanoxanthus Tul. ex Berk. Ann. Mag. Nat. Hist. 13: 359. 1844.

Ascocarp nearly globose, regular, verrucose, greenish-black; gleba yellow-green to black, marbled by obscure yellow or greenish veins; asci elongate to ellipsoid-clavate, short-stipitate; spores spherical, minutely spinose, irregularly arranged, 13–16 μ or larger (ours 16–22 μ).

TYPE LOCALITY: France.

HABITAT: Woods.

DISTRIBUTION: Maine, New Hampshire; Europe.

ILLUSTRATIONS: Tul. Fungi Hypog. pl. 4, f. 6; pl. 14, f. 4; Ore. St. Monogr. Bot. 1: pl. 1, f. 27.

7. *PIERSONIA* Hark. Proc. Calif. Acad. III. 1: 275. 1899.

Ascocarp subglobose; gleba with wide or narrow strands of sterile tissue separating irregular chambers lined by hymenium, these chambers sometimes appearing as colored dots on a cut surface, connected with the exterior by narrow venae externae; the latter short or forming long canals through the gleba and lined by more or less conspicuous paraphyses, some developing

into branched, tangled hyphae filling the veins. Hymenial chambers variously shaped by inward-projecting branches of interhymenial "tissue." Asci and paraphyses arranged in more or less regular palisade, crowded, the asci often deformed by crowding, generally somewhat clavate, 1-4-spored, often some spores not maturing; spores globose, yellow or brown, evenly alveolate; paraphyses fascicled between the asci, swollen at the tips.

Type species, *Piersonia alveolata* Hark.

Ascocarp less than 1.5 cm. in diameter; sterile tissue of the gleba forming veins generally narrower than the hymenial areas; asci with 1-4 (generally 4) mature spores. 1. *P. alveolata*. Ascocarp reaching 8 cm. in diameter; sterile tissue of the gleba generally broader than the hymenial areas, not forming distinct veins; asci with 1 or 2 (very rarely more) spores. 2. *P. bispora*.

1. *Piersonia alveolata* Hark. Proc. Calif. Acad. III. 1: 275. 1899.

Hydnobolites excavatum Hark. Proc. Calif. Acad. III. 1: 266. 1899.

Piersonia scabrosa Hark. Proc. Calif. Acad. III. 1: 275. 1899.

Pachyphloeus ligericus sensu Hark. Proc. Calif. Acad. III. 1: 269. 1899. Non *P. ligericus* Tul. 1851.

Ascocarp white, becoming yellow or brown, 1.5 cm. or less in diameter, slightly lobed, the surface scabrous, sometimes somewhat pubescent; gleba yellowish with orange-colored dots separated by lighter-colored veins; outer cortical structure consisting of tangled, branched hyphae often projecting from the surface as hairs; structure beneath becoming pseudoparenchymatous, of distinctly angled cells reaching 20 μ in diameter, the cells becoming smaller within, changing to compact hyphae running parallel with the surface; venae externae generally short, lined by paraphyses and filled with loose hyphae; venae internae much branched, mostly slender, consisting of compact hyphae and pseudoparenchyma; asci borne in distinct "nests" forming blind endings to the venae externae.

TYPE LOCALITY: Auburn, California.

HABITAT: "Beneath *Ceanothus*."

DISTRIBUTION: California, known from Placer County only.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: pl. 44, f. 20, 21; Univ. Calif. Publ. Bot. 6: pl. 28, f. 1-4; Ore. St. Monogr. Bot. 1: pl. 3, f. 67.

2. *Piersonia bispora* Gilkey, Univ. Calif. Publ. Bot. 6: 328. 1916.

Ascocarp reddish-brown, sometimes mottled with white, scabrous or slightly pubescent, reaching a diameter of 8 cm.; gleba whitish; venae externae forming long, more or less connected, winding canals through the gleba, ending in small fertile chambers; mature spores generally 2 or 1 to an ascus.

TYPE LOCALITY: Berkeley, California.

HABITAT: Not recorded.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 28, f. 5; Ore. St. Monogr. Bot. 1: pl. 3, f. 66.

8. *DENSOCARPA* Gilkey, gen. nov.*

Ascocarp hypogaeous or epigaeous, firm, with a broad mycelial area at the base, the upper surface often minutely downy and tending to crack irregularly, appearing tessellate at maturity; gleba penetrated by numerous chambers and winding canals lined by hymenium and filled at first by loose hyphae, these often breaking away raggedly in the wider cavities; peridium dark, minutely pseudoparenchymatous; gleba principally of compactly arranged hyphae or of prosenchyma. Hymenium consisting of asci and paraphyses in palisade, many of the paraphyses extending beyond the asci and filling the cavity with loose hyphae. Asci mainly cylindrical or

* *Densocarpa*; ascomatibus hypogaeis aut epigaeis, compactis, puncto adjunctionis myceliali instructis, superficie glabris vel minute velutinosis, saepe tessellatis; texto corticis minute pseudoparenchymatico; gleba firmula lacunis multiformibus, saepe gyroso-labyrinthicis, floccis trajectis, hymenio ex ascis paraphysibusque in vallum ordinatis vestitis; ascis cylindricis aut lente clavatis, octosporis; sporis globosis, levibus, saepe 1-4 tantum maturantibus, uniseriatis.

slightly clavate, normally 8-spored at first but with generally only 1-4 spores maturing; mature spores typically uniseriate, globose, smooth.

Type species, *Densocarpa Shanori* Gilkey.

1. *Densocarpa Shanori* Gilkey, sp. nov.*

Ascocarp fleshy, solid, nearly even above, shallowly lobed beneath, the lobes more or less clearly radiating from the base; color light pinkish cinnamon (R) to ferruginous (R), the upper surface obscurely or conspicuously marbled by shallow whitish cracks in the superficial layer, the lower surface bearing coarse, brownish mycelium clinging to masses of soil particles; mature spores uniseriate, globose, colorless, 16.5-19.5 μ ; some of the paraphyses swollen-tipped, slightly exceeding the asci; others elongated, indefinite, extending into the cavity to form a hyphal web.

TYPE: Collected at Urbana, Illinois, 14 June 1953, by L. Shanor; *H. M. Gilkey 749a*, in herb. H. M. G.

HABITAT: In lawns.

DISTRIBUTION: Michigan and Illinois.

ILLUSTRATION: *Mycologia* 47 (in press).

9. *CHOIROMYCES* Vitt. Monogr. Tuber. 50. 1831.

Hydnotryopsis Gilkey, Univ. Calif. Publ. Bot. 6: 336. 1916.

Ascocarp without mycelial tuft, the surface smooth; peridium thin, little differentiated. Gleba traversed by winding bands of hymenium embedded in hyphae or pseudoparenchyma; or gleba penetrated by irregular hypha-filled chambers lined by the hymenium. Asci from nearly cylindrical to nearly spherical, 8-spored; spores globose or ellipsoid, uniseriate or irregularly arranged, variously sculptured.

Type species, *Choiromyces meandriformis* Vitt.

Spores ellipsoid.

Spores 10-11 \times 12-13 μ .

Spores 16-18 \times 20-22 μ .

Spores globose.

1. *C. Setchellii*.

2. *C. compactus*.

3. *C. Cookei*.

1. *Choiromyces Setchellii* (Gilkey) Gilkey, Ore. St. Monogr.

Bot. 1: 33. 1939.

Hydnotryopsis Setchellii Gilkey, Univ. Calif. Publ. Bot. 6: 338. 1916.

Choiromyces ellipsosporus Gilkey, *Mycologia* 17: 252. 1925.

Ascocarp silver-white when young, becoming yellowish at maturity, 1-1.5 cm. in diameter, variously lobed, the surface minutely scabrous; peridium 200-250 μ thick, of course pseudoparenchyma continuous with the gleba; hymenium-lined winding canals originally filled with hyphae; or, more commonly, the walls of the canals in contact; asci delicate, clavate, stipitate; spores uniseriate or incompletely biseriata, globose-ellipsoid, 10-12 \times 12-14 μ , their surface papillose to minutely reticulate.

TYPE LOCALITY: California (exact location not known).

HABITAT: "In forests."

DISTRIBUTION: California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 30, f. 36*; *Mycologia* 17: *pl. 26, f. 4*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 35*.

2. *Choiromyces compactus* Gilkey, Ore. St. Monogr. Bot. 1:

34. 1939.

Ascocarp clay-color, 2-2.5 cm. in diameter, subglobose, firm, regular, minutely scabrous; peridium variable in thickness, consisting of closely compressed parenchyma and separate hyphae continuing into the looser-textured gleba; hymenial areas typically short, whitish; asci

* *Densocarpa Shanori*; ascomatibus carnosis solidis, dilute rubro-fuscis, rimis saepe albidis tessellatis, basi saepe lobatis, 2-4 cm.; sporis 16.5-19.5 μ , pellucidis.

cylindric to clavate; spores ellipsoid, 16–18 × 20–22 μ , uniseriate or generally irregularly arranged, minutely foveolate to reticulate.

TYPE LOCALITY: Guadaloupe Mines, California.

HABITAT: Not known.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl.* 2, *f.* 34.

3. *Choiromyces Cookei* Gilkey, sp. nov.*

Ascocarp 1–2 cm. in diameter, somewhat lobed, brown; cortex pseudoparenchymatous without, prosenchymatous within, changing to a layer of compact, separate hyphae; gleba marbled by dark veins separating rusty-brown, spongy areas filled with a somewhat distorted palisade of asci and knotted hyphae representing paraphyses; asci generally more or less globose, sometimes obovoid, 8-spored; spores globose, 20–26 μ in diameter, minutely and evenly papillose, irregularly arranged in the ascus.

TYPE: Collected on Eagle Peak Trail, Mt. Rainier, Washington, 10 July 1948, by W. B. Cooke (24238); *H. M. Gilkey 801*, in herb. H. M. G.

HABITAT: In soil of forests.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: *Mycologia* 47 (in press).

10. *BALSAMIA* Vitt. Monogr. Tuber. 30. 1831.

Ascocarp fleshy, firm, with or without a clearly-defined mycelial tuft; interior penetrated by blind canals and chambers, empty or nearly so, and lined by hymenium, the paraphyses in more or less evident palisade, the asci irregularly placed. Asci mostly ellipsoid or clavate, often long-stipitate, 8-spored; spores smooth, hyaline, ellipsoid, irregularly arranged.

Type species, *Balsamia vulgaris* Vitt.

1. *Balsamia platyspora* Berk. Ann. Mag. Nat. Hist. 13: 358. 1844.

Ascocarp chestnut-brown to ferruginous, verrucose; gleba white, the chambers and canals partly filled with hyphae; asci broadly ellipsoid to nearly cylindrical; spores somewhat variable in size, averaging 13 × 21 μ .

TYPE LOCALITY: Rudloe, England.

HABITAT: Unrecorded.

DISTRIBUTION: Quebec, Ontario; Europe.

ILLUSTRATION: Tul. Fungi Hypog. *pl.* 15, *f.* 2.

11. *HYDNOBOLITES* Tul. Ann. Sci. Nat. II. 19: 378. 1843.

Ascocarp subglobose, generally lobed or folded; cortex pseudoparenchymatous, changing to a loose hyphal structure toward the hymenium, or the whole structure of the fruiting body more or less pseudoparenchymatous; canals of the ascocarp labyrinthine, penetrating deeply into the gleba, lined by pseudoparenchyma, opening generally between the folds of the ascocarp surface; venae internae indistinct. Asci somewhat irregularly arranged between the canals, ellipsoid to pyriform, 8-spored; spores globose, alveolate, the angles of the alveoli projecting as spines; spores irregularly arranged in the ascus.

Type species, *Hydnobolites cerebriformis* Tul.

1. *Hydnobolites californicus* E. Fisch. Repert. Nov. Sp. 7: 194. 1909.

Ascocarp of gristly consistency, at first sordid, becoming brownish at maturity, 0.5–3 cm. in diameter, slightly to very irregularly folded, the canals opening at the furrows; surface bear-

* *Choiromyces Cookei*; ascomatibus 1–2 cm. diam., lente lobatis, brunneis; texto corticis externi pseudoparenchymatico aut prosenchymatico, interni in stratum compactum hyphalem transito; ascis subglobosis vel dilate obovoideis, octosporis; sporis globosis, 20–26 μ , minute papillatis.

ing occasional short, septate hairs of 2 or 3 cells; pseudoparenchymatous cortex continuing as the border of the canals, 8 μ thick; cells irregular in size, the inner somewhat smaller than the outer, changing gradually to the loose hyphae of the interior; hyphae coarse, 4–10 μ thick; canals narrow, mostly long, winding; asci scattered irregularly through the hyphal structure, irregularly globose-ellipsoid; spores yellowish at maturity, loosely arranged in the ascus, 14–18 μ , very coarsely alveolate, the angles projecting as coarse blunt spines 4 μ long; 3–4 alveoli across the diameter of the spore.

TYPE LOCALITY: Oakland, California.

HABITAT: Under trees.

DISTRIBUTION: Maine, Indiana, Tennessee, and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 30, f. 26*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 45*.

12. PSEUDOBALSAMIA E. Fisch. Ber. Deutsch. Bot. Ges. 25: 374. 1907.

Ascocarp infolded at the apex, the point of attachment of the mycelial tuft more or less distinct at the base, the surface verrucose; venae externae forming irregular canals filled with hyphae or somewhat open, hymenium-lined, converging toward the apex and opening to the surface at one or several points; paraphyses in more or less evident palisade, the asci irregularly placed. Asci 8-spored, globose-ellipsoid, deformed by the crowded spores, stipitate; spores smooth, hyaline, ellipsoid, irregularly arranged in the ascus. Very similar to *Balsamia* except in the surface-opening canals (venae externae) at the infolded apex of the ascocarp.

Type species, *Pseudobalsamia Setchelli* E. Fisch. [*P. magnata* (Hark.) Gilkey].

Ascocarp orange to reddish brown; verrucae rounded.

1. *P. magnata*.

Ascocarp black, verrucae sharp.

2. *P. nigrens*.

1. *Pseudobalsamia magnata* (Hark.) Gilkey, Univ. Calif. Publ. Bot. 6: 292. 1916.

Balsamia magnata Hark. Proc. Calif. Acad. III. 1: 264. 1899.

Balsamia alba Hark. Proc. Calif. Acad. III. 1: 264. 1899.

Balsamia filamentosa Hark. Proc. Calif. Acad. III. 1: 265. 1899.

Pseudobalsamia Setchelli E. Fisch. Ber. Deutsch. Bot. Ges. 25: 374. 1907.

Balsamia platyspora sensu Hark. Proc. Calif. Acad. III. 1: 265. 1899. Non *B. platyspora* Berk. 1844.

Balsamia polysperma sensu Hark. Proc. Calif. Acad. III. 1: 265. 1899. Non *B. polysperma* Vitt. 1831.

Ascocarp orange to reddish-brown, 1–2 cm. in diameter, somewhat depressed-globose, with a more or less persistent mycelial tuft at the base; surface verrucae pseudoparenchymatous throughout, the cells thick-walled, becoming smaller and thinner-walled below, changing to loose hyphae beneath the verrucae; interior of the ascocarp consisting of closely crowded folds, often united, separating labyrinthine canals or sometimes closed chambers, all lined by hymenium and generally filled with hyphae; paraphyses principally in regular palisade, the asci crowded and irregular; spores globose-ellipsoid, 12–14 \times 20–24 μ .

TYPE LOCALITY: Placer County, California.

HABITAT: Forests.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl. 43, f. 13*; E. & P. Nat. Pfl. ed. 2. 5b³: *f. 17*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 46*.

2. *Pseudobalsamia nigrens* (Hark.) Gilkey, comb. nov.

Balsamia nigrens Hark. Proc. Calif. Acad. III. 1: 264. 1899.

Pseudobalsamia magnata var. *nigrens* Gilkey, Univ. Calif. Publ. Bot. 6: 294. 1916.

Differs from *P. magnata* in the black ascocarp, the sharp and coarse verrucae, and the narrow venae externae closely filled with hyphae.

TYPE LOCALITY: Placer County, California.

HABITAT: "Under *Ceanothus*."

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl. 30, f. 33*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 47*.

13. TUBER Pers. ex Hook. Fl. Scot. 2: 10. 1821.

Aschion Wallr. Fl. Crypt. Germ. 2: 865. 1833.*Terfeziopsis* Hark. Proc. Calif. Acad. III. 1: 278. 1899.

Ascocarp regularly globose to very irregularly lobed, fleshy or somewhat cartilaginous, smooth or verrucose or coarsely tuberculate; cortex generally more or less pseudoparenchymatous; gleba penetrated by venae externae and venae internae, the latter sometimes obscure, the former opening to the surface at one or more points. Hymenium bordering the venae externae, in young specimens sometimes exhibiting a more or less regular palisade, but generally very irregular. Asci usually numerous, pyriform or nearly spherical, short- or long-stipitate, with 1-4 or more spores, the spore number and size varying in asci of a single ascocarp; spores ellipsoid or globose, alveolate or spinose, irregularly arranged in the asci.

Type species, *Tuber cibarium* Pers. ex Hook.

Spores alveolate.

Spores all globose.

Ascocarp pubescent (more or less); typically 6 or 7 alveoli across the diameter of the spores. 1. *T. californicum*.

Ascocarp glabrous; typically 3 or 4 alveoli across the diameter of the spores. 2. *T. sphaerosporum*.
At least some of the spores ellipsoid.

Spores frequently 50 μ or more long.

Spores often narrow-ellipsoid.

Spores rarely exceeding 52 μ ; alveoli not conspicuously large or few. 3. *T. gibbosum*.

Spores often reaching 60 μ or more; alveoli mostly few and coarse. 4. *T. Besseyi*.

Spores not conspicuously narrow.

Ascocarp verrucose over its entire surface. 5. *T. canaliculatum*.

Ascocarp not verrucose or with scattered verrucae.

Peridium thick (400-850 μ); pseudoparenchyma zone narrow. 6. *T. levissimum*.

Peridium thin (less than 400 μ); pseudoparenchyma conspicuous.

Alveoli of spores mostly few and large.

Spores mostly globose-ellipsoid. 7. *T. Shearii*.

Spores longer. 8. *T. irradians*.

Alveoli many and small or conspicuously variable.

Alveoli many; spores somewhat elongated. 9. *T. argenteum*.

Alveoli variable; spores mostly broadly ellipsoid. 10. *T. sepearans*.

Spores generally less than 45 μ long.

Ascocarp surface smooth or scabrous.

Alveoli of spores minute, many. 11. *T. monticola*.

Alveoli larger, fewer, 3-7 across the diameter.

Outer cortical layer coarsely pseudoparenchymatous, changing within to slender hyphae. 12. *T. dryophilum*.

Pseudoparenchyma cells of cortex no wider than the hyphae within. 13. *T. citrinum*.

Ascocarp verrucose.

Spores globose to subglobose, alveoli many, minute. 14. *T. Linsdalei*.

Spores mostly long-ellipsoid.

Spores yellow, coarsely alveolate (3-5 \times 4-7 alveoli). 15. *T. longisporum*.

Spores brown, 3-11 \times 5-14 alveoli. 16. *T. Gardneri*.

Spores spinose.

Ascocarp smooth, or with a few verrucae at the folds. 17. *T. candidum*.

Ascocarp conspicuously verrucose throughout. 18. *T. Harknessii*.

1. *Tuber californicum* Hark. Proc. Calif. Acad. III. 1:

274. 1899.

Tuber magnatum sensu Hark. Proc. Calif. Acad. III. 1: 272. 1899. Non *T. magnatum* Picco ex Vitt. 1831.

Tuber puberulum sensu Hark. Proc. Calif. Acad. III. 1: 273. 1899. Non *T. puberulum* Berk. & Br. 1846.

Ascocarp whitish to ochraceous, 1.5-2.5 cm. in diameter, much lobed, the surface unevenly pubescent; gleba brown, marbled by large pale veins; cortex somewhat pseudoparenchymatous; subcortex of loose irregular branched hyphae; thickness of the peridium averaging 200 μ ; venae externae large, branching, irregular in width, filled with loose branching hyphae; venae internae inconspicuous; palisade of paraphyses sometimes seen in the hymenium; asci short-stipitate, semiglobose to globose, 72-88 \times 72-100 μ , 1-4- (rarely 5- or 6-) spored; spores dark brown, globose, 39-52 μ , alveolate, with 3-9 (generally 6 to 7) alveoli across their diameter.

TYPE LOCALITY: Alameda County, California.
 HABITAT: In oak and other woods.
 DISTRIBUTION: Ohio, Oregon, and California.
 ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl.* 45, *f.* 31; Univ. Calif. Publ. Bot. 6: *pl.* 29, *f.* 20;
 Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 53.

2. **Tuber sphaerosporum** Gilkey, Ore. St. Monogr. Bot. 1:
 39. 1939.

Ascocarp 2.5 cm. or less in diameter, glabrous to scabrous, brown; gleba dark, marbled by a few large and small whitish veins; outer cortical layer of variable cells, the large and small intermixed, somewhat pseudoparenchymatous or often prosenchymatous, changing within to a loose hyphal structure; venae externae of loose hyphae; paraphyses sometimes forming a somewhat distinct palisade; spores dark brown, globose, 32–58 μ , coarsely alveolate, with generally 3 or 4 alveoli across their diameter.

TYPE LOCALITY: Burbank, Tennessee.
 HABITAT: Under trees.
 DISTRIBUTION: Quebec and Tennessee.
 ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 59.

3. **Tuber gibbosum** Hark. Proc. Calif. Acad. III. 1:
 273. 1899.

Tuber giganteum Gilkey, Mycologia 17: 250. 1925.

Ascocarp 1.5–5.5 cm. in diameter, subglobose, lobed to nearly regular, meaty, crisp, the surface scabrous to minutely pubescent, light buff (R) and Mikado brown (R), with the wide, white endings of the venae externae conspicuous on the surface of fresh specimens; gleba wood brown (R) to brick red (R) at maturity, marbled by distinct shining white veins; outer cortical layer pseudoparenchymatous, the superficial cells often forming branched, knotted hairs more or less parallel with the surface; venae externae loose, spongy, generally opening in the surface depressions filled with irregular hairs; asci 1–6- (rarely 7- or 8-) spored; spores dark yellowish-brown, mostly long-ellipsoid, 17–40 \times 35–52 μ , generally rounded at the ends, alveolate, with 5–9 \times 7–10 alveoli across their diameters, the spore surface reticulate beneath the alveoli.

TYPE LOCALITY: Mill Valley, California.
 HABITAT: Under trees.
 DISTRIBUTION: Oregon and California.
 ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl.* 29, *f.* 15; Mycologia 17: *pl.* 26, *f.* 1; Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 54.

4. **Tuber Besseyi** Gilkey, Ore. St. Monogr. Bot. 1: 40. 1939.

Ascocarp deep olive-buff (R), 0.8–4 cm. in diameter, scarcely lobed, minutely scabrous or rarely minutely and irregularly verrucose; gleba darker, marbled by a few large venae externae and slender, dark venae internae; peridium 300–800 μ thick at the exits of the venae externae, pseudoparenchymatous near the surface, changing to inner prosenchyma; venae externae sometimes bordered by an interrupted palisade of paraphyses; asci 1–4-spored; spores dark brown, 20–40 \times 36–70 μ , very narrow with pointed ends to somewhat broadly ellipsoid, generally coarsely and irregularly alveolate, with 3–6 \times 4–9 alveoli across their diameters.

TYPE LOCALITY: Ithaca, New York.
 HABITAT: Mixed woods.
 DISTRIBUTION: Quebec, New York, Michigan, Saskatchewan, Nebraska, British Columbia, and Oregon.
 ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 51.

5. **Tuber canaliculatum** Gilkey, Mycologia 12: 99. 1920.

Tuber bisporum Gilkey, Mycologia 17: 251. 1925.

Ascocarp brown to brick-red, reaching 3.5 cm. in diameter, the surface conspicuously verrucose; veins conspicuous, whitish; outermost cortical tissue pseudoparenchymatous, changing

within somewhat abruptly to prosenchyma, then to more or less unconnected hyphae toward the hymenium; thickness of the cortex 360–800 μ ; venae internae inconspicuous, of unconnected, somewhat irregularly arranged hyphae, those bordering the venae externae sometimes distinctly parallel, some ending at the vein margins as more or less regularly arranged and somewhat swollen-tipped paraphyses, others continuing inward to form the loose interwoven structure filling the venae externae; the latter much enlarged in places, the hyphal structure of the narrower portions sometimes breaking away, leaving empty channels through the ascocarp; asci short-stipitate, semiglobose to pyriform or cylindric, 72–88 \times 96–120 μ , 1–3- (generally 2-) spored; spores dark brown, ellipsoid to nearly globose, 40–64 \times 48–72 μ , alveolate, with 4–8 \times 5–9 alveoli across their diameters; sculpturing 4–6 μ thick, the surface of the spore minutely reticulate beneath.

TYPE LOCALITY: Allegan County, Michigan.

HABITAT: Woods.

DISTRIBUTION: New York, Ontario, Michigan, and Kentucky.

ILLUSTRATIONS: Mycologia 12: 100, f. 1; 17: pl. 26, f. 3; Ore. St. Monogr. Bot. 1: pl. 3, f. 55.

6. **Tuber levissimum** Gilkey, Univ. Calif. Publ. Bot. 6:
313. 1916.

Ascocarp clay-brown, 2 cm. or less in diameter, even, the surface smooth; veins large, inconspicuous in color; thickness of the peridium 420 to 840 μ ; asci subglobose to globose, 50–80 \times 70–100 μ , 1–4- (rarely 5-) spored; spores dark brown, mostly broad-ellipsoid, 32–52 \times 36–58 (rarely 65) μ , alveolate, the alveoli irregular in size and number on the spore, 3–10 \times 4–13 across their diameters, the surface of the spore minutely reticulate beneath the alveoli.

TYPE LOCALITY: California. Exact locality unknown.

HABITAT: Under shrubs and trees.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 30, f. 31; Ore. St. Monogr. Bot. 1: pl. 3, f. 63.

7. **Tuber Shearii** Hark. in Murrill, Mycologia 12: 157. 1920.

Terfezia oligosperma sensu Shear, Asa Gray Bull. 7: 118. 1899. Non *T. oligosperma* Tul. 1851.

Ascocarp 0.5–3 cm. in diameter, creamy-buff to rusty-tawny, subrotund, the surface smooth or scabrous; peridium 160–400 μ thick, pseudoparenchymatous near the surface, changing within to prosenchyma and separate hyphae; asci subglobose, 50–70 μ in diameter; spores subglobose to globose, dark brown, 35–56 \times 30–56 μ , alveolate, the alveoli rather uniform, 3–6 \times 3–7 across their diameters.

TYPE LOCALITY: Takoma Park, Maryland.

HABITAT: In woods.

DISTRIBUTION: Maine, Maryland, Ohio, and Wisconsin.

ILLUSTRATIONS: Mycologia 12: 157, f. 1; Ore. St. Monogr. Bot. 1: pl. 3, f. 62.

8. **Tuber irradians** Gilkey, Univ. Calif. Publ. Bot. 6:
316. 1916.

Ascocarp brown, approximately 1 cm. in diameter, depressed-globose, somewhat lobed, the surface irregularly verrucose; gleba brown at maturity, the veins few, little-branched, white; peridium pseudoparenchymatous, the cells thin-walled, large (to 24 μ), in more or less clearly distinct radial rows to a depth of 140–160 μ , changing abruptly to a loose hyphal structure; thickness of the peridium 380 μ or more; asci pyriform to subglobose, 44–64 \times 70–94 μ , sometimes long-stipitate, readily separable from the hyphae; spores 1–3 (generally one or 2) in an ascus, brown, ellipsoid, 28–48 \times 36–56 μ , alveolate, the number of alveoli variable, 3–8 \times 3–9 (usually 5 \times 6) across their diameters; sculpturing 4–6 μ thick.

TYPE LOCALITY: Alameda County, California.

HABITAT: In woods.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 29, f. 16, 17; Ore. St. Monogr. Bot. 1: pl. 3, f. 64,
65.

9. **Tuber argenteum** Gilkey, Univ. Calif. Publ. Bot. 6:
318. 1916.

Ascocarp silver-white, reaching 2.5 cm. in diameter, depressed, irregular, convolute, the surface smooth or somewhat tessellated, sometimes bearing slender, short, blunt, septate hairs; gleba brownish with white, branching veins; cortex pseudoparenchymatous or coarsely and loosely hyphal; subcortical layer very loosely hyphal; thickness of the peridium 100–200 μ ; venae internae numerous; asci with or without a short stipe, semiglobose, 1–4- (generally 1- or 2-) spored; spores dark brown, ellipsoid, sometimes with one end acute, 28–44 \times 38–60 μ , regularly and mostly evenly alveolate, with 6–9 \times 7–10 alveoli across their diameters.

TYPE LOCALITY: San Francisco County, California.

HABITAT: In sand among needles of *Pinus attenuata*.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 30, f. 28; Ore. St. Monogr. Bot. 1: pl. 2, f. 30.

10. **Tuber separans** Gilkey, Univ. Calif. Publ. Bot. 6:
315. 1916.

Ascocarp earthy-brown, 1–1.2 cm. in diameter, semiglobose, convolute, the surface very minutely scabrous; gleba similar in color to the surface of the ascocarp, the veins inconspicuous; cortex conspicuously pseudoparenchymatous, the cells becoming smaller within and changing to the compact subcortical layer of unconnected hyphae; thickness of the peridium 200–260 μ ; venae internae very compact, the hyphae parallel, often connected, in places becoming pseudoparenchymatous; venae externae of loose, tangled hyphae; asci short-stipitate, semiglobose, 1–3- (rarely 4-) spored; spores brown, globose-ellipsoid, 40–56 \times 48–58 μ , alveolate, with 3–10 \times 7–11 (commonly 6–7 \times 8–9) alveoli across their diameters.

TYPE LOCALITY: Alameda County, California.

HABITAT: Beneath oaks in clay soil.

DISTRIBUTION: California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 29, f. 19; Ore. St. Monogr. Bot. 1: pl. 3, f. 60.

11. **Tuber monticola*** Hark. Proc. Calif. Acad. III. 1:
271. 1899.

Ascocarp dingy white, averaging 1.5 cm. in diameter, lobed, the surface slightly scabrous; cortex minutely pseudoparenchymatous, the cells varying little in size, the walls not thickened, the pseudoparenchyma changing gradually to very loose, branched hyphae; thickness of the peridium 280–640 μ ; asci subglobose, 2–4-spored; spores globose-ellipsoid, very minutely alveolate, with 11–14 \times 12–16 alveoli across their diameters; spores 28–34 \times 32–40 μ .

TYPE LOCALITY: Towle, Placer County, California.

HABITAT: Among firs in dense woods in the Sierra Nevada Mountains.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: pl. 30, f. 23; Ore. St. Monogr. Bot. 1: pl. 3, f. 57.

12. **Tuber dryophilum** Tul. Fungi Hypog. 147. 1851.

Tuber unicolor Gilkey, Mycologia 12: 100. 1920.

Ascocarp yellow-brown, 1–2 cm. or more in diameter, nearly regular to somewhat convolute or sometimes deeply furrowed, the surface smooth to somewhat scabrous; gleba yellowish-brown with narrow, white veins; outer cortex coarsely pseudoparenchymatous, changing within to irregular prosenchyma and loose hyphae; peridium variable in thickness, generally not greater than 400 μ ; venae externae conspicuous, long, branching; asci inconspicuous, embedded, semiglobose, 1–6-spored; spores brownish, ellipsoid or a few nearly globose, 20–38 \times 22–40 μ (rarely slightly larger), the alveoli few, large, the sculpturing generally 6 μ or more thick, with needle-like angles often conspicuous.

* As "monticolum."

TYPE LOCALITY: Italy.
 HABITAT: Under trees.
 DISTRIBUTION: New Hampshire, New York, New Jersey, Pennsylvania, District of Columbia, Virginia, Michigan; Europe.
 ILLUSTRATIONS: Tul. Fungi Hypog. *pl.* 5, *f.* 3; *pl.* 19, *f.* 8; Mycologia 12: 100, *f.* 1; Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 56.

13. *Tuber citrinum* Hark. Proc. Calif. Acad. III. 1: 271. 1899.

Ascocarp pale yellow, 2 cm. or less in diameter, somewhat convolute, the surface smooth; veins large, inconspicuous in color; outer cortical structure pseudoparenchymatous, gradually changing to prosenchyma and finally to the hyphae of the subcortex; thickness of the peridium 400–540 μ or more; venae internae of long-celled, loose, irregular, unconnected hyphae, scarcely branched, 5 μ thick; venae externae of coarse, much-branched hyphae; asci stipitate, subglobose, 1–4-spored; spores ellipsoid, 26–36 \times 30–44 μ , alveolate, with about 7 \times 8 alveoli across their diameters.

TYPE LOCALITY: Marin County, California.
 HABITAT: In forest.
 DISTRIBUTION: California.
 ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl.* 45, *f.* 30; Univ. Calif. Publ. Bot. 6: *pl.* 29, *f.* 18; Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 52.

14. *Tuber Linsdalei* Gilkey, sp. nov.*

Tuber australe sensu Hark. Proc. Calif. Acad. III. 1: 272. 1899. Non *T. australe* Speng. 1880.

Ascocarp one cm. or less in diameter, brown, scarcely lobed, the surface minutely verrucose; gleba paler than the surface, the veins whitish, few; outer cortical layer pseudoparenchymatous; asci mainly 1–3-spored, generally with only one or two spores; spores 32–52 \times 32–58 μ , globose to globose-ellipsoid, dark brown, alveolate, the alveoli small and numerous.

TYPE: Collected at Hastings Memorial Reservation, Carmel Valley, Monterey County, California, 24 May 1945, by J. M. Linsdale; *H. M. Gilkey 822*, in herb. H. M. G.
 HABITAT: Under trees.
 DISTRIBUTION: Monterey and Placer Counties, California.
 ILLUSTRATIONS: Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 53 (as *T. australe*); Mycologia 47 (in press).

15. *Tuber longisporum* Gilkey, Mycologia 17: 251. 1925.

Ascocarp purplish-brown (preserved in alcohol), slightly lobed, 1–1.5 cm. in diameter, the surface somewhat coarsely verrucose; gleba brown (in preserved material); cortex coarsely and regularly pseudoparenchymatous, light brown in color for 100 μ or more inward from the bases of the verrucae, changing rather abruptly to a subcortex of whitish, coarse, compactly arranged, more or less united hyphae; thickness of the complete peridium below the bases of the verrucae 200–450 μ ; verrucae 100–200 μ high; venae externae of loose hyphae which sometimes break away in older ascocarps, leaving wide, hollow canals; venae internae of somewhat closely associated but unconnected coarse hyphae; asci fragile, 1–4-spored; spores yellow, mostly long-ellipsoid, generally somewhat pointed at both ends, 20–33 \times 27–45 μ , coarsely alveolate, with 3–5 \times 4–7 alveoli across their diameters.

TYPE LOCALITY: Ithaca, New York
 HABITAT: In woods.
 DISTRIBUTION: New York.
 ILLUSTRATIONS: Mycologia 17: *pl.* 26, *f.* 2; Ore. St. Monogr. Bot. 1: *pl.* 3, *f.* 61.

16. *Tuber Gardneri* Gilkey, Univ. Calif. Publ. Bot. 6:
 317. 1916.

Ascocarp brown, averaging 1.5 cm. in diameter, subglobose, with small convolutions, the surface minutely verrucose; gleba brown at maturity, with wide, conspicuous, white veins;

* *Tuber Linsdalei*; ascomatibus 0.5–1 cm. diam., fuscis, subglobois, regularibus, superficie minute verrucosis; gleba dilute brunnea, venis paucis, albis; texto corticis externi pseudoparenchymatico; ascis 1- vel 2- (rare 3-) sporis; sporis alveolatis, 32–52 \times 32–58 μ , globois aut semiglobois, alveolis 5–11 \times 6–14 trans diam.

outer cortical layer somewhat coarsely pseudoparenchymatous, the cells occasionally reaching $18\ \mu$ in diameter, thin-walled, changing gradually to a subcortical layer of unconnected hyphae, $2\text{--}4\ \mu$ thick; asci not stipitate, subglobose or rarely elongated, 1-5-spored; spores dark brown, ellipsoid, $24\text{--}30 \times 28\text{--}48$ (rarely 58) μ , alveolate, with $3\text{--}11 \times 5\text{--}14$ alveoli across their diameters.

TYPE LOCALITY: Alameda County, California.

HABITAT: Under trees of various species.

DISTRIBUTION: Oregon and California.

ILLUSTRATIONS: Univ. Calif. Publ. Bot. 6: *pl.* 30, *f.* 30; Ore. St. Monogr. Bot. 1: *pl.* 2, *f.* 31.

17. **Tuber candidum** Hark. Proc. Calif. Acad. III. 1: 274. 1899.

Tuber Eisenii Hark. Proc. Calif. Acad. III. 1: 275. 1899.

Tuber olivaceum Hark. Proc. Calif. Acad. III. 1: 275. 1899.

Terfeziopsis lignaria Hark. Proc. Calif. Acad. III. 1: 279. 1899.

Tuber Lyoni Butters, Bot. Gaz. 35: 431. 1903.

Tuber lignarium Gilkey, Univ. Calif. Publ. Bot. 6: 324. 1916.

Ascocarp light to orange-brown, reaching 3.5 cm. in diameter, subglobose, with one furrow or generally several connected furrows, mostly on one side, the furrows sometimes united into circles forming "eyes" of a different color from the general ascocarp surface, usually pinkish in young specimens; surface of the ascocarp smooth, with occasional small papillae about the furrows; veins mostly large, whitish, conspicuous, converging at the furrows; cortex minutely and compactly pseudoparenchymatous, changing to a subcortical layer of hyphae running parallel to the surface; thickness of the peridium $200\text{--}360\ \mu$; asci mainly long-stipitate, generally ovoid, readily separated from the hyphae, 1-7-spored; spores brown, exceedingly variable in shape from globose-ellipsoid to long-ovoid, $22\text{--}32 \times 28\text{--}48\ \mu$, their surface covered by minute or somewhat coarse spines.

TYPE LOCALITY: Placer County, California.

HABITAT: Under trees or shrubs.

DISTRIBUTION: Quebec, New York, Maryland, Michigan, Ohio, Tennessee, Minnesota, Manitoba, Oregon, and California.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: *pl.* 44, *f.* 23; *pl.* 45, *f.* 32; Bot. Gaz. 35: 428-430, *f.* 1-3; Univ. Calif. Publ. Bot. 6: *pl.* 27; *pl.* 30, *f.* 25; Ore. St. Monogr. Bot. 1: *pl.* 4.

18. **Tuber Harknessii** Gilkey, nom. nov.

Tuber Caroli sensu Hark. Proc. Calif. Acad. III. 1: 274. 1899. Non *T. Caroli* H. Bonnet, 1885.

Ascocarp 1-2 cm. in diameter, scarcely lobed, reddish-brown, the surface distinctly divided into low polygonal areas; gleba compact, paler than the surface, marbled by conspicuous white veins somewhat converging at a common base; asci long-stipitate, 1-4-spored; spores brown, ovoid or ellipsoid, $26\text{--}35\ \mu$ in length, clothed with slender spines.

TYPE LOCALITY: Alameda County, California.

HABITAT: Under oaks.

DISTRIBUTION: Alameda, Marin, and Monterey Counties, California, and Oregon.

14. **LESPIAULTINIA** Zobel in Corda, Ic. Fung. 6: 55. 1854.

Delastreopsis Matt. Bol. Soc. Brot. 21: 95. 1906.

Ascocarp 0.5-3 cm. in diameter, regular to more or less lobed; outer cortical structure pseudoparenchymatous to prosenchymatous, changing inward to loose hyphae; peridium and gleba penetrated at intervals by loose-textured venae externae. Asci closely crowded, somewhat thick-walled, short-stipitate, 1-4-spored; spores globose (rarely slightly subglobose), spinose-reticulate.

Type species, *Terfezia oligosperma* Tul. [*Lespiaultinia Requienii* Zobel = *L. oligosperma* (Tul.) Gilkey].

Peridium thick, penetrated by long, paraphysis-lined, sterile canals.
Sterile canals not present in peridium.

1. *L. phleboderma*.
2. *L. oligosperma*.

1. Lespiaultinia phleboderma (Gilkey) Gilkey, comb. nov.

Delastreopsis phleboderma Gilkey, Ore. St. Monogr. Bot. 1: 49. 1939.

Ascocarp buff, 1 cm. or less in diameter, nearly even, minutely scabrous; peridium thick (reaching 800 μ), traversed by meandering sterile venae externae lined by paraphyses and continuing from the fertile venae externae of the gleba; gleba brown, a palisade of paraphyses bordering the venae externae in places, but generally deformed by crowding; asci numerous, generally 1-2-spored; spores mostly globose, yellowish, 36-52 μ .

TYPE LOCALITY: Benton County, Oregon.

HABITAT: Mixed woods.

DISTRIBUTION: Benton and Lane Counties, Oregon.

ILLUSTRATION: Ore. St. Monogr. Bot. 1: *pl. 2, f. 32*.

2. Lespiaultinia oligosperma (Tul.) Gilkey, comb. nov.

Terfezia oligosperma Tul. Fungi Hypog. 176. 1851.

Lespiaultinia Requienii Zobel in Corda, Ic. Fung. 6: 65. 1854 (nomen illegitimum).

Delastreopsis oligosperma Matt. Bol. Soc. Brot. 21: 95. 1906.

Ascocarp yellowish, nearly smooth; asci often 1- or 2-spored; spores yellowish, 30-46 (rarely 50) μ , the reticulation uniform on each spore, but varying on different spores of the ascocarp.

TYPE LOCALITY: France.

HABITAT: Woods.

DISTRIBUTION: Quebec; France, Portugal, Palestine.

ILLUSTRATIONS: Tul. Fungi Hypog. *pl. 21, f. 15*; Ore. St. Monogr. Bot. 1: *pl. 2, f. 33*; Palest. Jour. Bot. R. 4: 195, 196, *f. 1, 2; pl. 5*.

Family 3. TERFEZIACEAE

Ascocarp compact, fleshy, with no internal cavities or venae externae. Gleba divided by sterile veins into nest-like areas containing asci, these clavate to nearly spherical. Spores ellipsoid, fusiform, or globose, smooth or sculptured.

Spores smooth or (in *Carbomyces*) sometimes with scattered minute papillae.

Ascocarp surface smooth.

Spores globose or if ellipsoid, with scattered minute papillae.

Spores ellipsoid, smooth (known only from north Africa).

Ascocarp verrucose; spores (in ours) fusiform.

Spores conspicuously alveolate, spinose, or tuberculate.

Asci 8-spored.

Asci nearly spherical.

Asci elongated (known only from southern Europe).

Asci 1-5-spored.

Spores globose.

Spores ellipsoid (known only from Japan).

1. CARBOMYCES.

TIRMANIA.

2. PICOA.

3. TERFEZIA.

MATTIROLOMYCES.

4. DELASTRIA.

MUKAGOMYCES.

1. CARBOMYCES Gilkey, gen. nov.*

Ascocarp compact, hypogaeous or epigaeous, more or less globose but with a suggestion of a slightly narrowed, darker base; peridium firm when dry, its texture somewhat that of carbonized wood; outer layer coarsely pseudoparenchymatous; innermost layer of coarse, free or more or less fused, branching hyphae, this layer continuing into the gleba as a network of veins surrounding nests of closely-packed minute asci; mature asci brownish, broadly obovate to globose, thick-walled, often eventually released from the hyphae, and tardily and irregularly dehiscent to allow gradual escape of the spores; spores 8, globose or broadly ellipsoid, smooth or with minute scattered papillae, brownish.

Type species, *Carbomyces emergens* Gilkey.

Spores globose, smooth.

Spores short-ellipsoid, minutely papillose.

1. *C. emergens*.

2. *C. Longii*.

1. *Carbomyces emergens* Gilkey, sp. nov.†

Ascocarp shining white, becoming yellowish, hypogaeous or epigaeous, 3-4 cm. in diameter; glebal veins olive-buff (R), the fertile areas medal bronze (R); asci thick-walled, brown; spores globose, brown, smooth, 10-19 μ .

TYPE: Collected at Carlsbad, New Mexico, 2 November 1916, by W. H. Long; *H. M. Gilkey 403b*, in herb. H. M. G.

HABITAT: Sandy soil under shrubs.

DISTRIBUTION: New Mexico and California.

ILLUSTRATION: *Mycologia* 47 (in press).

2. *Carbomyces Longii* Gilkey, sp. nov.‡

Ascocarp white at first, becoming yellowish or pale brownish, hypogaeous; veins olive-buff (R); asci brownish, broadly ellipsoid to nearly spherical; spores ellipsoid, brownish, 16 \times 20-23 μ , minutely papillose.

* **Carbomyces**; ascomatibus firmis, hypogaeis aut epigaeis, subglobosis, basi obconica instructis; texto corticis externi crasse pseudoparenchymatico; textis subcorticis hyphis laxis et irregulariter positus composito; venis in structura strato subcorticali similibus; ascis obovatis vel globosis, octosporis, in glebulis veluti inordinate creberrimis nidulantibus; sporis minutis, globosis aut ellipsoideis, levibus aut minute papillosis.

† **Carbomyces emergens**; ascomatibus argenteo-albis tandem luteis, hypogaeis aut epigaeis, 3-4 cm. diam; venis olivaceis; ascis dilute fuscis; sporis globosis, 10-19 μ diam., levibus.

‡ **Carbomyces Longii**; ascomatibus albis, tandem luteis, hypogaeis, 2-3 cm. diam., venis olivaceis; ascis dilute fuscis; sporis ellipsoideis, dilute fuscis, 16 \times 20-23 μ , minute papillosis.

TYPE: Collected in Oscura area, New Mexico, 18 April 1942, by W. H. Long; *H. M. Gilkey 798*, in herb. H. M. G.

HABITAT: Not recorded.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: *Mycologia* 47 (in press).

2. *PICOA* Vitt. Monogr. Tuber. 54. 1831.

Leucangium Quéf. Assoc. Fr. Av. Sci. Compte Rendu 11: 404. 1883.

Phaeangium Pat. Jour. de Bot. 8: 155. 1894.

Ascocarp without a mycelial tuft, the surface minutely verrucose or papillose; peridium thin, pseudoparenchymatous; gleba marbled by sterile veins. Asci globose to clavate; spores smooth, ellipsoid or fusiform.

Type species, *Picoa Juniperi* Vitt.

1. *Picoa carthusiana* Tul. Fungi Hypog. ed. 2. xxiv. 1862.

Ascocarp dusky slate-violet (R), 0.5–4.5 cm. in diameter, minutely papillose; peridium thin, coarsely pseudoparenchymatous; gleba at first cartridge buff (R), becoming greenish-blue marbled with buff, consisting of coarse, loose, branching hyphae forming somewhat anastomosing sterile veins separating fertile areas; asci globose-ellipsoid, nearly sessile to abruptly long-stipitate, 60–120 μ in diameter, 8-spored; spores at first colorless, pellucid, becoming greenish-yellow, 24–32 \times 74–80 μ , lemon- or spindle-shaped, the ends variable, sharply acute to rounded, both extremes sometimes present on a single spore; body of spore nearly filled by a large guttule.

TYPE LOCALITY: Near Carthusian monastery, France.

HABITAT: Mixed Woods.

DISTRIBUTION: Oregon; Europe.

ILLUSTRATIONS: E. & P. Nat. Pfl. 1: f. 222 H; ed. 2. 5b⁸: f. 20E; Ore. St. Monogr. Bot. 1: pl. 2, f. 36.

3. *TERFEZIA* (Tul.) Tul. Fungi Hypog. 172. 1851.

Choiromyces sect. *Terfezia* Tul. Ann. Sci. Nat. III. 3: 350. 1845.

Tulasneinia Zobel in Corda, Ic. Fung. 6: 64. 1854 (nomen illegitimum).

Ascocarp fleshy, with or without an evident mycelial tuft. Fruiting areas rounded, separated by an irregular network of sterile veins. Asci ellipsoid to nearly globose, 8-spored; spores globose, the surface verrucose, spinose, or alveolate-spinose.

Type species, *Choiromyces Leonis* Tul. [*Terfezia Leonis* (Tul.) Tul.].

Spores 44–52 μ , minutely roughened.

Spores less than 30 μ .

Spores coarsely and regularly alveolate and spinose, crowded in small inconspicuous asci.

Spores spinose, spines irregularly anastomosing at base; spores loosely arranged in large conspicuous asci.

1. *T. gigantea*.

2. *T. Longii*.

3. *T. spinosa*.

1. *Terfezia gigantea* Imai, Proc. Acad. Japan 9: 183. 1933.

Ascocarp 5 cm. or more in diameter, the surface nearly smooth but marked off, apparently by the cracking of the thin superficial layer, into low polygonal areas, and with evidence of early tomentum; peridium 800 μ or more thick, the superficial cells variable, some forming knotted hairs of tomentum; subsurface layer coarsely pseudoparenchymatous, changing gradually to the smaller-celled prosenchyma and the loose hyphal structure of the fertile interior; asci nearly globose, 100–120 μ in diameter; spores globose, 44–52 μ , aniline yellow (R), minutely roughened by more or less coalescent granules or by obscure alveolation, the epispore 3–4 μ thick.

TYPE LOCALITY: Hokkaido, Ishikari Province, Japan.

HABITAT: Forests.

DISTRIBUTION: Pennsylvania; Japan.

ILLUSTRATIONS: Proc. Acad. Japan 9: 185, f. 8–10; *Mycologia* 39: 443, f. 15, 16.

2. *Terfezia Longii* Gilkey, *Mycologia* 39: 448. 1947.

Ascocarp subglobose, reaching 3.5 cm. in diameter, whitish, smooth; outer layer of the peridium coarsely pseudoparenchymatous, changing to prosenchyma and loose hyphae; sterile veins principally of loose hyphae, the walls of all the cells very thin; asci globose to somewhat elongate, averaging 60–80 μ , inconspicuous, not readily separable from the glebal hyphae, generally closely packed with spores; spores 20–24 μ (including spines), coarsely alveolate with generally slender spines at the angles of the alveoli; number of spines on the circumference averaging 15 or fewer.

TYPE LOCALITY: Near Corono, New Mexico.

HABITAT: "Sagebrush areas near sandhill-juniper dunes."

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: *Mycologia* 39: 443, f. 17.

3. *Terfezia spinosa* Hark. Proc. Calif. Acad. III. 1: 277. 1899.

Ascocarp subglobose, white or citron, smooth; peridium consisting of both parallel and tangled hyphae interspersed with areas of pseudoparenchyma; asci many, subglobose to often long and narrow, averaging 100–120 μ , conspicuous, readily separable from the glebal hyphae, the spores loosely arranged within; spores 24–28 μ , spinose, the spines sometimes slender or more often blunt at the apex and broadened at the base, the bases sometimes anastomosing over the surface of the spore to form an interrupted alveolation; number of spines on the circumference averaging 20 or more.

TYPE LOCALITY: Red River Valley near Natchitoches, Louisiana.

HABITAT: Sandy ground.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Proc. Calif. Acad. III. 1: pl. 45, f. 24; Ore. St. Monogr. Bot. 1: pl. 2, f. 37.

EXSICCATI: Ell. & Ev. N. Am. Fungi 1782.

4. *DELASTRIA* Tul. Ann. Sci. Nat. II. 19: 379. 1843.

Ascocarp irregularly globose, sometimes lobed, scabrous or minutely floccose; peridium somewhat distinct. Sterile veins of varying thickness anastomosing and dividing the gleba into rounded fertile areas. Asci often deformed, clavate or long-ellipsoid, more or less curved, 2–4-spored; spores globose, alveolate, with angles extending into spines.

Type species, *Delastria rosea* Tul.

1. *Delastria rosea* Tul. Ann. Sci. Nat. II. 19: 380. 1843.

Ascocarp 1–2.5 cm. in diameter, subglobose, somewhat convolute, the surface minutely scabrous; veins of the gleba somewhat indistinct, dividing it into roundish areas, these at first rose-colored, later brownish; asci 2–4-spored; spores uniseriate in the ascus, globose, alveolate-spinose.

TYPE LOCALITY: Italy.

HABITAT: Leaf mold under trees and shrubs.

DISTRIBUTION: California; France; Italy.

ILLUSTRATIONS: Corda, Ic. Fung. 6: pl. 20, f. 145; Tul. Fungi Hypog. pl. 8, f. 1; pl. 16, f. 1; Proc. Calif. Acad. III. 1: pl. 45, f. 27; E. & P. Nat. Pfl. ed. 2. 5b³: f. 22; Ore. St. Monogr. Bot. 1: pl. 2, f. 38.

EXCLUDED GENUS

The expressed conclusion by Dr. F. J. Seaver [N. Am. Cup-Fungi (Operc.) suppl. ed. 336, 337] of the synonymy of *Durandiomyces Phillipsii* (Masse) Seaver and *Daleomyces Gardneri* Setchell, and their inclusion, as *Daleomyces Phillipsii* (Masse) Seaver, in the cited work provide at least a temporary resting place in the Pezizales for *Daleomyces*, which was originally described under the Tuberales. In the opinion of the present writer, synonymy of the two can neither be proved nor disproved until more convincing comparative field studies are possible. In the meantime, the genus is being excluded from this study, though the present disposition of the genus leaves unaccounted-for *Daleomyces Shearii* Gilkey, Ore. St. Monogr. Bot. 1: 26 (1939), a species with distinctive spore characters.

BIBLIOGRAPHY

BY DONALD PHILIP ROGERS

- Berkeley, Miles Joseph, 1803–1889 (Berk.).**
Ann. Mag. Nat. Hist. 13: 340–360. *pl.* 9. My 1844.—Notices of British fungi [continued].
- Berkeley, Miles Joseph, 1803–1889; Broome, Christopher Edmund, 1812–1886 (Berk. & Br.).**
Ann. Mag. Nat. Hist. 18: 73–82. Au 1846.—Notices of British hypogaeous fungi.
- Bessey, Ernst Athearn, 1877– ; Thompson, Bertha Emogene, 1871–1925 (Bess. & Thomps.).**
Mycologia 12: 282–285. *pl.* 20. 4 S 1920.—An undescribed *Genea* from Michigan.
- Bonnet, Alexis Elzéard Henri, 1823–1892 (H. Bonnet).**
- Bucholtz, Fedor Vladimirovič, 1872–1924 (Bucholtz).**
- Butters, Frederic King, 1878–1945 (Butters).**
Bot. Gaz. 35: 427–431. *f.* 1–3. 20 Je 1903.—A Minnesota species of *Tuber*.
- Corda, August Carl Josef, 1809–1849 (Corda).**
Ic. Fung. 1837–1854.—Icones fungorum hucusque cognitorum. [In six volumes.]
6: [I]–XVIII, [1], 1–91. *pl.* 1–20. 1854.
Edited after Corda's death by Johann Baptista Zobel.
- Ellis, Job Bicknell, 1829–1905; Everhart, Benjamin Matlack, 1818–1904 (Ell. & Ev.).**
N. Am. Fungi 1501–3600. 1886–1898.—North American fungi. Second series. [Exsiccati.]
Continuation of Ellis, N. Am. Fungi.
For dates of issue see N. Am. Flora 7: 1062; 9: 435.
- Engler, Heinrich Gustav Adolf, 1844–1930; Prantl, Karl Anton Eugen, 1849–1893 (E. & P.).**
Nat. Pfl. 1887–1911.—Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen.
In 4 parts containing 23 divisions, with 4 sets of additions to parts 2–4 and an index to the whole.
Nat. Pfl. ed. 2. 1924–1943.—Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten, insbesondere den Nutzpflanzen. Zweite stark vermehrte und verbesserte Auflage.
20 parts in 21 volumes have been published.
- Fischer, Eduard, 1861–1939 (E. Fisch.).**
Ber. Deutsch. Bot. Ges. 25: 372–376. *1f.* 28 Au 1907.—Über einige kalifornische Hypogaeen.
Bot. Zeit. 66¹: 141–168. *pl.* 6. 1908.—Zur Morphologie der Hypogaeen.
In E. & P. Nat. Pfl. 1¹: 278–290. *f.* 202–209. D 1896.—Tuberineae.
For date of printing see p. 278.
In E. & P. Nat. Pfl. ed. 2. 5b⁸: 1–42. *f.* 1–22. 29 Ap 1938.—Tuberineae.
Repert. Nov. Sp. 7: 193, 194. 15 Au 1909.—Diagnosen einiger Fungi hypogaei aus Californien.
- Fischer, Eduard, 1861–1939; Mattiolo, Oreste, 1856–1947 (Fisch. & Matt.).**
- Fries, Elias Magnus, 1794–1878 (Fries).**

Gilkey, Helen Margaret, 1886- (Gilkey).

Mycologia 12: 99-101. *f. 1.* 8 Ap 1920.—Two new truffles.

Mycologia 17: 250-254. *pl. 26.* 1 N 1925.—Five new hypogaeous fungi.

Mycologia 39: 441-452. *f. 1-17.* 11 Au 1947.—New or otherwise noteworthy species of Tuberales.

Mycologia 47: —Taxonomic notes on Tuberales [in press].

Ore. St. Monogr. Bot. 1: 1-63. *pl. 1-5.* 1 Mr 1939.—Tuberales of North America.

Univ. Calif. Publ. Bot. 6: 275-356. *pl. 26-30.* 31 Mr 1916.—A revision of the Tuberales of California.

Harkness, Harvey Willson, 1821-1901 (Hark.).

Bull. Calif. Acad. 1: 159-176. *pl. 1.* 28 F 1885.—Fungi of the Pacific coast.

Proc. Calif. Acad. III. 1: 241-292. *pl. 42-45.* 8 J1 1899.—Californian hypogaeous fungi.

Hooker, William Jackson, 1785-1865 (Hook.).

Fl. Scot. My 1821.—Flora scotica; or a description of Scottish plants, arranged both according to the artificial and natural methods.

1: i-x, [1], 1-292, [4]. 2: 1-297, [6].

For date of issue see *Mycologia* 43: 378 (1951).

Imai, Sanshi, 1900- (Imai).

Proc. Acad. Japan 9: 182-185. *f. 1-10.* Ap 1933.—On two new species of Tuberaceae.

Mattirolo, Oreste, 1856-1947 (Matt.).

Bol. Soc. Brot. 21: 86-105. 1906.—Prima contribuzione allo studio della flora ipogea del Portogallo.

For the year of issue see p. 217.

Malpighia 14: 247-270. 1901.—Elenco dei "Fungi hypogaei" raccolti nelle Foreste di Vallambrosa negli anni 1899-1900.

Though Vol. 14 is dated 1900, it appeared in monthly parts ["fascicles"; see *Hedwigia* 40: (161) (20 O 1901) and the subtitle, "rassegna mensile"]; the article is dated D 1900 and can hardly have appeared before 1901. See also p. 529.

Murrill, William Alphonso, 1869- (Murrill).

Mycologia 12: 157-158. *f. 1.* 5 Je 1920.—Another new truffle.

Patouillard, Narcisse Théophile, 1854-1926 (Pat.).

Jour. de Bot. 8: 153-156. 16 Ap 1894.—Les terfèz de la Tunisie.

Persoon, Christiaan Hendrik, 1761-1836 (Pers.).**Picco, Vittorio,** (Picco).

The name was latinized as Picus on the title-page of his *Melathemata inauguralia* (1788); the plates, however, are signed "Picco del."

Quélet, Lucien, 1832-1899 (Quél.).

Assoc. Fr. Av. Sci. Compte Rendu 11: 387-412. *pl. 11, 12.* 1883.—Quelques espèces critiques ou nouvelles de la flore mycologique de France.

Ridgway, Robert, 1850-1929 (R).

Col. Stand. & Nomencl. 1-44. *pl. 1-53.* 1912.—Color standards and color nomenclature.

Seaver, Fred Jay, 1877- (Seaver).

N. Am. Cup-Fungi (Operc.) suppl. ed. i-viii, 1-377. *f. 1-23. pl. 1-74, frontisp.* 31 Ja 1942.—The North American cup-fungi (Operculates). Supplemented edition.

Shear, Cornelius Lott, 1865- (Shear).

Asa Gray Bull. 7: 118. D 1899.—A truffle from Maryland.

Spegazzini, Carlo Luigi, 1858-1926 (Speg.).

Anal. Soc. Ci. Argent. 10: 145-168. O 1880.—Fungi argentini (continuacion).

Tulasne, Louis René Edmond Étienne, 1815–1885; Tulasne, Charles, 1816–1884 (Tul.).

The elder Tulasne was generally known as Louis René; he signed his correspondence "Edmond"; he is named "Edmond-Louis-René" in Bull. Soc. Bot. Fr. 32²: 234 (1886); and as above in Ann. Sci. Nat. X. 16: liii (1934).

Ann. Sci. Nat. II. 19: 373–381. *pl.* 17. 1843.—Champignons hypogés de la famille des Lycoperdacées, observés dans les environs de Paris et les départemen[t]s de la Vienne et d'Indre-et-Loire.

Ann. Sci. Nat. III. 3: 348–353. 1845.—De gen. *Choiromycete* et *Picoa* e Tuberacearum familia.

Fungi Hypog. 1–xx, 1–222, [1]. *pl.* 1–21. 1851.—Fungi hypogaei. Histoire et monographie des champignons hypogés.

Fungi Hypog. ed. 2. 1–xxiv, 1–222, [1]. *pl.* 1–21. 1862.—Fungi hypogaei. Histoire et monographie des champignons hypogés. Editio altera.

Title-page bears the date 1853; the preface is dated 1862 (p. xxiv); Lindau & Sydow, Thesaurus 2: 669 (1909) give 1863.

Gior. Bot. Ital. I. 2: 55–63. 1845.—Fungi nonnulli hypogaei, novi v. minus cogniti.

The volume is dated 1844; but the authors quote (p. 61) Ann. Sci. Nat. III. 2: 316–319 (late 1844). Many articles are dated 1845; the first bears the date 19 D 1844.

Vittadini, Carlo, 1800–1865 (Vitt.).

Monogr. Tuber. [8], 1–88. *pl.* 1–5. 1831.—Monographia Tuberacearum.

Wallroth, Carl Friedrich Wilhelm, 1792–1857 (Wallr.).

Fl. Crypt. Germ. 1831–1833.—Flora cryptogamica Germaniae.

2: I–LVI, 1–923. 1833.

Also titled: [Bluff & Fingerh.] Compendium florum germanicarum. Sectio II. Plantae cryptogamicae s. cellulosae. Tomus IV.

Zobel, Johann Baptista, 1812–1865 (Zobel).**SERIALS**

Anal. Soc. Ci. Argent.—Anales de la Sociedad Científica Argentina. Vols. 1–156→. 1874–1953→.

Ann. Mag. Nat. Hist.—The annals and magazine of natural history. Vols. 6–20. 1840–1847. Continuation of (Vols. 1–5) Annals of natural history.

Ann. Sci. Nat. II.—Annales des sciences naturelles. Seconde série. Botanique. Vols. 1–20. 1834–1843.

Ann. Sci. Nat. III.—Annales des sciences naturelles. Troisième série. Botanique. Vols. 1–20. 1844–1853.

Ann. Sci. Nat. X.—Annales des sciences naturelles. Dixième série. Botanique. Vols. 1–20. 1919–1938.

Asa Gray Bull.—The Asa Gray bulletin. Vols. 1–8. 1893–1900.

The first number bore the title Bulletin of the Gray Memorial Botanical Chapter of the Agassiz Association.

Assoc. Fr. Av. Sci. Compte Rendu—Association Française pour l'Avancement des Sciences. Compte Rendu. Vols. 1–69→. 1873–1951→.

Ber. Deutsch. Bot. Ges.—Berichte der Deutschen Botanischen Gesellschaft. Vols. 1–67→. 1883–1954→.

Bol. Soc. Brot.—Boletim da Sociedade Broteriana. Vols. 1–28. 1883–1920.

Vols. 1–3 were entitled Sociedade Broteriana. Boletim annual.

Bot. Gaz.—The botanical gazette. Vols. 2–115→. 1876–1953→.

Continuation of (Vol. 1) Botanical bulletin.

- Bot. Zeit.**—Botanische Zeitung. Vols. 1–68. 1843–1901.
In Vols. 1–50, numbers refer to columns not pages.
- Bull. Calif. Acad.**—Bulletin of the California Academy of Science. Vols. 1, 2. 1884–1887.
- Bull. Soc. Bot. Fr.**—Bulletin de la Société Botanique de France. Vols. 1–100→. 1854–1953→.
- Gior. Bot. Ital.**—Giornale botanico italiano. [“Anno”] I. Vols. 1–3. 1844–1845. [“Anno”] II. Vols. 1–3. 1847–1852.
Continued as Nuovo giornale botanico italiano.
- Jour. de Bot.**—Journal de botanique. Vols. 1–22. 1887–1910.
- Malpighia.**—Malpighia. Rassegna mensile (mensile) di botanica. Vols. 1–34. 1886–1937.
- Mycologia.**—Mycologia. Vols. 1–46→. 1909–1954→.
- Ore. St. Monogr. Bot.**—Oregon state monographs. Studies in botany. Nos. 1–10→. 1939–1950→.
- Palest. Jour. Bot. R.**—Palestine journal of botany. Rehovot series. Vols. 1→. 1935→.
- Proc. Acad. Japan**—Proceedings of the Imperial Academy (of Japan). Vols. 1–21². 1912–F 1945.
Continued as Proceedings of the Japan Academy. Note on 1945 covers says “(The Imperial Academy of Japan till Dec., 1947)”; but the title of the Proceedings was changed in Mr 1945.
- Proc. Calif. Acad. III.**—Proceedings of the California Academy of Sciences. Third series. Botany. Vols. 1, 2. 1897–1904.
- Repert. Nov. Sp.**—Repertorium novarum specierum regni vegetabilis. Vols. 1–7. 1905–1909.
Continued as Repertorium specierum novarum. . . .
- Univ. Calif. Publ. Bot.**—University of California publications (in) botany. Vols. 1–27→. 1902–1953→.

INDEX

Numbers in **boldface** type refer to descriptions; *italic* refers to the listing of a name as a synonym; ordinary type indicates names in keys and incidentally mentioned.

- Aschion, *19*
 Balsamia, 9, **17**
 alba, *18*
 filamentosa, *18*
 magnata, *18*
 nigrens, *18*
 platyspora, **17**, **18**
 polysperma, *18*
 vulgaris, *17*
 Barssia, 9, **13**
 oregonensis, **13**
 Carbomyces, **27**
 emergens, **27**
 longii, **27**
 Caulocarpa, 9, **13**
 montana, **13**
 Choeromyces *ellipsosporus*, *16*
 Choiromyces, 9, **16**
 sect. *Terfezia*, *28*
 compactus, **16**, **17**
 cookei, **16**, **17**
 ellipsosporus, see *Choeromyces*
 gangliformis, *14*
 leonis, *28*
 meandriformis, *16*
 melanoxanthus, *14*
 setchellii, *16*
 Daleomyces, **29**
 gardneri, **29**
 phillipsii, **29**
 shearii, **29**
 Delastria, **27**, **29**
 rosea, **29**
 Delastreopsis, **24**
 oligosperma, **25**
 phleboderma, **25**
 Densocarpa, 9, **15**, **16**
 shanori, *16*
 Durandiomyces, **29**
 phillipsii, **29**
 FIscherula, 9
 Genabea, 3, **7**
 fragilis, **7**
 Genea, **3**, **4**
 sect. *Eugenea*, **4**
 sect. *Heterogenea*, **6**
 subg. *Eugenea*, **4**
 subg. *Heterogenea*, **6**
 subg. *Myrmecocystis*, **6**
 arenaria, **4**
 brachytheca, **4**, **5**
 cerebriformis, **7**
 compacta, **4**, **5**
 cubispora, **11**
 echinospora, **4**
 gardneri, **6**
 harknessii, **6**
 hispidula, **4**, **5**
 [Genea]
 intermedia, **7**
 macrosiphon, **4**, **5**
 thaxteri, **4**, **5**, **6**
 verrucosa, **4**
 Geneaceae, **1**, **3**
 Geopora, 9, **12**
 annulata, **12**
 cooperi, **12**
 harknessii, **12**
 magnata, **12**
 magnifica, **12**
 Hydnobolites, 9, **17**
 californicus, **17**, **18**
 cerebriformis, **17**
 excavatum, **15**
 Hydnocaryon, **3**
 Hydnocystis, **9**
 californica, **9**, **10**
 compacta, **7**
 piligera, **9**
 thwaitesii, **3**
 Hydnoplicata, **3**
 Hydnotrya, 9, **10**
 cerebriformis, **10**
 cubispora, **10**, **11**, **12**
 ellipsospora, **10**, **11**
 tulasnei, **10**
 variiformis, **10**, **11**
 yukonensis, **10**, **11**
 Hydnotriopsis, **16**
 setchellii, **16**
 Labyrinthomyces, **9**
 Lespiaultinia, 9, **24**
 oligosperma, **24**, **25**
 phleboderma, **24**, **25**
 requienii, **24**, **25**
 Leucangium, *28*
 Mattirolomyces, **27**
 Mukagomyces, **27**
 Myrmecocystis, 3, **6**
 candida, **7**
 cerebriformis, **6**, **7**
 compacta, **6**, **7**
 Pachyphloeus, 9, **13**
 carneus, **14**
 citrinus, **14**
 ligericus, **15**
 melanoxanthus, **14**
 virescens, **14**
 Paradoxa, **9**
 Petchiomyces, **3**
 kraspedostoma, **3**
 thwaitesii, **3**
 Phaeangium, *28*
 Phymatomyces, **9**
 Picoa, **27**, **28**
 carthusiana, **28**

[Picoa]

- juniperi, 28
- Piersonia, 9, 14, 15
 - alveolata, 15
 - bispora, 15
 - scabrosa, 15
- Pseudobalsamia, 9, 18
 - magnata, 18
 - var. nigrens, 18
 - setchelli, 18
- Pseudogenea, 6
 - californica, 7
- Pseudhydnotrya, 12
 - carnea, 12
 - harknessii, 12
 - nigra, 12
- Stephensia, 9
- Terfezia, 27, 28
 - gigantea, 28
 - longii, 28, 29
 - oligosperma, 21, 24, 25
 - spinosa, 28, 29
- Terfeziaceae, 1, 27
- Terfeziopsis, 19
 - lignaria, 24
- Tirmania, 27
- Tuber, 9, 19
 - argenteum, 19, 22
 - australe, 23
 - besseyi, 19, 20
 - bisporum, 20

[Tuber]

- californicum, 19
- canaliculatum, 19, 20, 21
- candidum, 19, 24
- caroli, 24
- cibarium, 19
- citrinum, 19, 23
- dryophilum, 19, 22
- eisenii, 24
- gardneri, 19, 23, 24
- gibbosum, 19, 20
- giganteum, 20
- harknessii, 19, 24
- irradians, 19, 21
- levissimum, 19, 21
- lignarium, 24
- linsdalei, 19, 23
- longisporum, 19, 23
- lyoni, 24
- magnatum, 19
- monticola, 19, 22
- olivaceum, 24
- puberulum, 19
- separans, 19, 22
- shearii, 19, 21
- sphaerosporum, 19, 20
- unicolor, 22
- Tuberaceae, 1, 9
- Tuberales, 1
- Tulasneinia, 28