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STUDIES IN THE GENUS HELOTIUM, IV SOME MISCELLANEOUS SPECIES[1]

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In this series of papers such familiar names as *Helotium citrinum*, *H. cyathoideum*, *H. fructigenum*, *H. herbarum*, and *H. virgultorum*, and the species to which they apply, have been avoided, while *H. epiphyllum* and *H. scutula* have been subjected to only preliminary treatment. These names have in common the fact that they are pre-Friesian, represent species which have fairly large apothecia, are of widespread distribution, and are of common occurrence. They are the species most frequently found by the collector. They have been recorded many times, but in no case have they received detailed or modern taxonomic treatment. The problems they offer are intricate and difficult and not susceptible to quick solution. These problems are being disentangled gradually and it is hoped that treatments of at least some of the pre-Friesian species may be made ready for publication in the near future. In the meantime the present installment comprises a sorting out of a miscellany of eight species, which have been under consideration for the past three or more years, and for which the accumulated taxonomic data appear to be as complete as they can be made at the present time. They are species occurring in either Europe or North America or which are common to both continents. Each is represented by one to several collections providing enough material to permit the preparation of what should prove to be fairly adequate descriptions; none of them ranks among the more common or so-called better known members of the genus.

A complete and critical bibliography is attempted for all the species except no. 5, *H. albidum*. Microscopic observations are based on material mounted in KOH-phloxine. Drawings showing structure are made from freehand sections. Technical color terms are those of Ridgway. Herbarium abbreviations are those of Lanjouw to which extra letters are added when needed to designate subdivisions or private collections: CU-P = Plant Pathology Herbarium at Cornell University; CU-PD = its Durand Herbarium; CU-PF = its Fairman Herbarium; FH = Farlow Herbarium; FH-E = its Ellis Herbarium; NY = New York Botanical Garden Herbarium; NY-E = its Ellis Collection; NY-M = its Massee

[1] Contribution from the Laboratories of Cryptogamic Botany and the Farlow Herbarium, Harvard University, no. 224.

[2] The writer, now on leave to the Chemical Warfare Service Development Laboratory, Massachusetts Institute of Technology, wishes to express his thanks to Dr. Rolf Singer of the Farlow Herbarium for preparing the Latin diagnoses, and to the several individuals who have contributed specimens, in particular to Professor H. M. Fitzpatrick and Dr. Fred J. Seaver for making available important historic material under their care at Cornell University and the New York Botanical Garden respectively, and to Professor H. H. Whetzel of Cornell University for supplying so many of the more recent collections.

Collection; OTB = Botany Department Herbarium, Central Experimental Farm, Ottawa; US = Pathology and Mycology Collections, United States Department of Agriculture.

1. **Helotium citrinulum** Karsten, Symb. Myc. Fenn. I, Not. Soc. Fauna Fl. Fenn. **11**: 238. 1871. — Karst., Myc. Fenn. I, Bidr. Kann. Finl. Nat. Folk, p. 139. 1871. — Sacc., Michelia **2**: 613. 1882. — Sacc., Fungi Ital. *fig. 1357*. 1883. — Karst., Rev. Monogr., Acta Soc. Fauna Fl. Fenn. **2**[6]: 127. 1885. — Fairm., Ann. Myc. **8**: 331. 1910. — Höhn., Mitt. Bot. Inst. Techn. Hochsch. Wien **3**: 74. 1926. — Seym., Host Index, p. 137, 1929. — Gola, L'Erb. Mic. Sacc., p. 119. 1930.
Pezizella citrinula (Karst.) Sacc., Syll. Fung. **8**: 288. 1889. — Rehm, *in* Rabenh., Krypt.-Fl. **1**[3]: 680. 1893; 1266. 1896. — J. Lind, Danish Fungi, p. 119. 1913, specim. doubtful. — Vel., Monogr. Discom. Bohem. **1**: 171; **2**: *pl. 25, fig. 62*. 1934, specim. doubtful. — Oud., Enum. Syst. Fung. **1**: 682, 808, 820. 1919.
Hymenoscypha citrinula (Karst.) Schröt., *in* Cohn, Krypt.-Fl. Schlesien **3**[2]: 71. 1893.
Helotium flexuosum Massee, Brit. Fung.-Fl. **4**: 263. 1895. — Sacc., Hedwigia **35**[7]: 36. 1896. — Sacc., Syll. Fung. **14**: 765. 1899. — Boud., Hist. Classif. Discom. Europe, p. 113. 1907. — Ramsb., Brit. Myc. Soc. Trans. **4**: 373. 1913. — Oud., Enum. Syst. Fung. **1**: 852. 1919. — Vel., Monogr. Discom. Bohem. **1**: 170 (under *P. Dactylidis* Schröt.). 1934. — White, Mycologia **34**: 172. 1942.
Helotium citrinulum Karst. var. *Seaveri* Rehm, Ann. Myc. **4**: 67. 1906. — Seaver, Bull. Lab. Nat. Hist. State Univ. Iowa **6**: 103. 1910. — Sacc., Syll. Fung. **22**: 650. 1913. — Höhn., Mitt. Bot. Inst. Techn. Hochsch. Wien **3**: 74, 105. 1926.
Mollisiella citrinula (Karst.) Boud., Hist. Classif. Discom. Europe, p. 142. 1907.

FIGURES 1–5.

Apothecia scattered, not numerous, sessile, attached by a broad central portion, free at the margin, when fresh 0.8–1.2 mm. diam., rarely reaching 1.7 mm., bright dilute yellow, concolorous on all parts, of medium thickness, plane to convex, strongly convex with maximum water content, drying fairly thin, plane to saucer-shaped; **receptacle** always smooth, on drying remaining yellow or turning slightly whitish; **hymenium** drying firmly waxy and opaque, becoming deep golden yellow, varying among "Cadmium Yellow," "Light Orange Yellow," "Deep Chrome," or "Ochraceous Buff," sometimes in very old herbarium specimens deepening to "Sanford's Brown"; **margin** lying close to the substratum in fresh material, on drying turning upward, finally usually slightly elevated, smooth, regular; **in section** 170–200 μ thick from substratum to hymenial surface, colorless or practically so; *medullary region* prosenchymatous, rather open, the hyphae thin-walled, 4–6 μ diam., rarely reaching 10 μ; *ectal layer* thick and well differentiated, pseudoparenchymatous, the cells thin-walled, 4–10 μ diam., isodiametric, angular, or more or less elongate in direction from center to outside, not crowded; **paraphyses** mostly once-forked at or below the middle, a few of them simple or twice-forked, the apices clavate-enlarged, 2–3.5 μ diam.; **asci** originating from croziers, clavate-cylindric, 40–55 x 6–7 μ; **ascospores** biseriate in the upper part of the ascus, uniseriate below, elongate, straight to slightly curved or irregular, thickest at or above the middle, more or less obtusely pointed at the ends, 7–11 x 2–2.5 μ, 1-celled, or in some specimens a few 2-celled, the content homogeneous, lacking oil globules.

Habitat: On dead culms and leaves of grasses and sedges, perhaps also on other monocotyledonous plants; most frequent on wooded hillsides and always appearing well down among the basal portions of the plants where the parts are constantly moist, only rarely found on plants growing in swamps or other habitats:

Distribution and specimens examined: NORTH AMERICA, **Massachusetts:** On *Carex* sp., Wakefield, May 2, 1942, *D. H. Linder & W. L. White* (FH). — **New York:** Lyndonville, Apr. 1906, *C. E. Fairman*, as *Helotium citrinulum* Karst., det. Rehm, reported by Fairman in 1910 (l. c.) (CU-PF). — On *Phleum pratense* L., Forest Home, Ithaca, May 14, 1907, *E. J. Durand & H. H. Whetzel* (CU-PD *5181*). — On *Carex plantaginea* Lam., Labrador Lake, May 5, 1936, *W. L. White* (CU-P *25189*, FH, NY, OTB). —Additional collections from same locality and substratum: May 16, 1936, *White* (FH); May 9, 1937, *White* (FH); May 23, 1937, *White* (FH). — On *Carex* sp. (not *plantaginea*), Labrador Lake, May 23, 1937, *White* (FH). — On *Carex* sp., Arnot Forest, near Ithaca, May 25, 1937, *White 2953, 2954* (FH). — On grass, Arnot Forest, May 25, 1937, *White* (CU-P *25823*, FH). — **Ontario:** On *Maianthemum canadense* Desf. (according to the collector), Bear Island, L. Temagami, May 29, 1936, *J. W. Groves*, Univ. Toronto Crypt. Herb. *17620*, comm. H. S. Jackson (FH). — On *Carex* sp., May 1905, *F. J. Seaver*, Rehm Ascom. *1634*, type of *Helotium citrinulum* var. *Seaveri* (CU-P, FH). — On *Carex* sp., June 8, 1905 (CU-PD *502*, NY-M). — EUROPE: **Finland:** On *Carex vesicaria* L., Mustiala, Finl. Fungi comm. Karsten, authentic material of *Helotium citrinulum* (NY). Karsten (1871) noted that he had encountered the species several times on gramineus hosts about Helsingfors and Mustiala in April and May. — **? Denmark:** From the dubious report of Lind (1913), which assumes that *H. album* Schum., unknown since 1801 may be identical with Karsten's species. — **Germany:** Reported by Rehm (1893) on grasses and by Schröter (1893) on grasses and on *Carex vaginata* Tausch. — **? Czechoslovakia:** Reported by Velenovsky on *Phragmites* sp. Description and illustrations poor. — **France:** Based on report by Saccardo (1882 and 1883) of its occurrence on *Phragmites communis* Trin. Illustrations good. — **England:** "Near base of culms of *Dactylus glomerata*." Shere, Surrey, type of *Helotium flexuosum* (NY-M).

The species is distinguished by its golden yellow, broadly sessile, and rather spreading apothecia, and by its occurrence on dead grasses and sedges for a short period in the spring of the year. In aspect the apothecia are similar to those of *Helotium callorioides* Rehm as illustrated by Boudier on his plate *444* sub *Calycella callorioides* (Rehm) Boud. The apothecia of *Helotium citrinulum*, however, are not lobed as Boudier illustrates those of *H. callorioides*, and they are attached to the substratum by a broader basal portion than is indicated in Boudier's illustration, though it is not always as broad as I have illustrated it in the accompanying diagram (Fig. 1). These apparent differences are at best minor, and a perusal of Rehm's original description of *H. callorioides* (Hedwigia **21** (7): 98. 1882), together with that of Boudier, indicates that the lobed condition is probably not normal for that species and that the apothecia are entirely sessile. As another difference, also of probable minor significance, may be mentioned the fact that the material thus far referred to *H. citrinulum* has been on monocotyledonous substrata, while Rehm's material of *H. callorioides* was on the ranunculaceous *Aconitum variegatum* and that of Boudier on *A. napellus*. No ma-

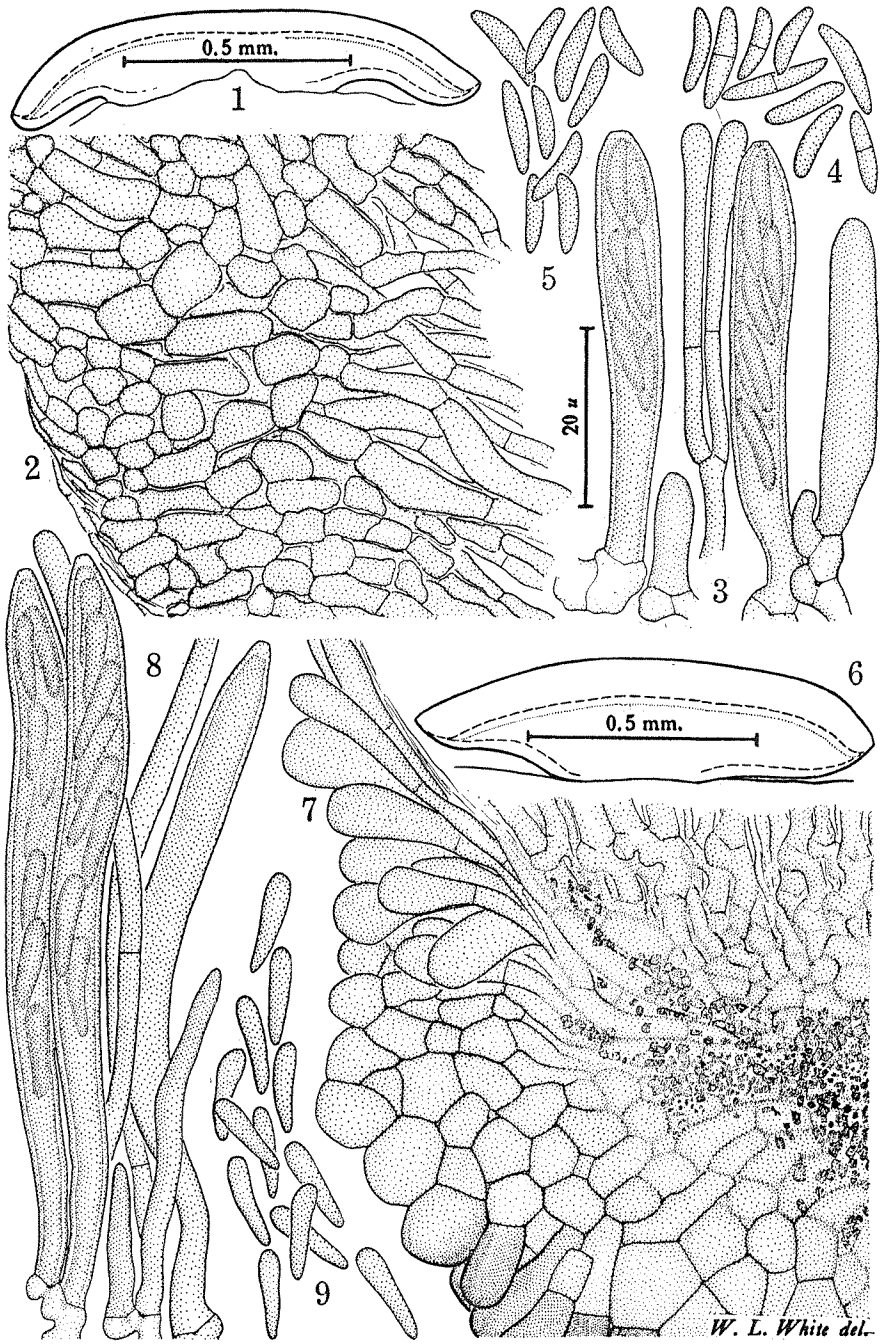
terial of *H. callorioides* is available for examination. Karsten's specific epithet, *H. citrinulum*, has priority in case the two species should later prove to be synonymous.

The several collections here presented as *Helotium citrinulum* have been carefully studied and they indicate a species of rather uniform characters. The Karsten and Massee specimens show a hymenium of somewhat deeper color than the others, but this may be due, in part at least, to age; at any rate, the degree of coloring in the yellow species of *Helotium* has proven entirely unreliable as a taxonomic character. The specimens exhibit little or no variation in the structure of the apothecium (Fig. 2). They further show remarkable uniformity of the various hymenial elements: all have paraphyses that are predominantly once-branched at or near the middle (Fig. 3) but occasionally simple or twice-forked, and which are noticeably clavate-enlarged at the immediate apex. All have asci (Fig. 3) originating from rather poorly developed croziers which do not stain well, and appear to be without content, and thus are difficult to discern clearly under the microscope. The spores (Fig. 4–5) are characteristically variable within each collection but show no noticeable variation among the several specimens, with the exception that about half those of the Finland (Karst.) specimen (Fig. 4) examined are septate, as is also true of the Ontario specimen. Septate spores have not been seen in any of the other collections. The spores, whether from fresh or herbarium material, never contain oil globules or granular content. All specimens have been taken during the spring of the year. That the species actually is limited in apothecial production to a brief period at this season is attested by the fact that repeated search at Labrador Lake, N. Y., where it was known to produce apothecia on *Carex plantaginea* during May always failed to reveal any fruit bodies after the latter part of that month.

Mass ascospore cultures were made from CU-P *25189*. The ascospores germinated readily on potato dextrose agar at room temperature and did not become septate in the process. A rather rapidly growing white mycelium developed. In old cultures the mycelium and also the agar became decidedly yellow. The cultures were carried for a year during which period, transfers were subjected to various conditions of temperature and humidity, but no fruit bodies, stromata, or spores of any kind ever developed.

Fig. 1–5, Helotium citrinulum: 1, Diagrammatic representation of section through an apothecium, × 74 (CU-P *25189*); **2,** Section through the ectal excipulum at base of hymenium showing structure. From specimen taken at Wakefield, Mass., × 1290 (FH); **3,** Asci and paraphyses. From Karsten specimen as *H. citrinulum*, × 1290 (NY); **4,** Ascospores from same specimen, × 1290; **5,** Ascospores from type of *H. flexuosum*, × 1290 (NY-M).

Fig. 6–9, Pezizella culmigena, all from **type** (FH): **6,** Diagrammatic representation of section through an apothecium, × 74; **7,** Section showing structure of disc tissue, × 1290; **8,** Asci and paraphyses, × 1290; **9,** Ascospores, × 1290.



FIGURES 1–9

2. **Pezizella culmigena** Sacc., Ann. Myc. **12**: 292. 1914. — Sacc., Syll. Fung. **24**[2]: 1189. 1928.

FIGURES 6–9.

Apothecia subgregarious, rather numerous, sessile, attached by a broad central portion or at least appearing so, free at the margin, yellow, about 0.6–1.1 mm. diam. when dry, not perceptibly larger when moistened, when dry fairly thin, plane to saucer-shaped, when moistened somewhat thicker, cushion-shaped; **receptacle** smooth, when dry turned slightly off the substratum at the margin, slightly olive-brown toward the base, pale yellow above, "Chamois" to "Honey Yellow," on moistening remaining nearly the same color, lying closely adjacent the substrate; **margin** circular, even, rarely slightly lobed or angular, obtuse, rather thin, when dry even with the hymenium or slightly elevated, when moistened directed outward and downward against the substratum, concolorous with upper part of receptacle; **hymenium** when dry plane, waxy, concolorous with receptacle and margin, becoming slightly convex on moistening; **in section** 170–200 μ thick from substrate to hymenial surface; *medullary region* very compact, of indeterminate structure, containing a large amount of crystalline material; *ectal layer* distinct, well differentiated, about 30 μ thick at the base, somewhat thinner toward the margin, composed of compact, more or less angular, thin-walled cells 9–12 μ diam., colorless except for those in the outer layer which in the basal region of the apothecium are brown and have walls slightly thickened, those at the margin of the disc clavate; **paraphyses** simple, colorless, thin-walled, non-staining, slightly clavate at the apex, 3–4 μ diam.; **asci** originating from croziers, narrow, clavate, 65–68 x 6–7 μ; **ascospores** biseriate in the upper part of the ascus, uniseriate below, cuneate, rounded above, tapering to an obtuse point below, straight or slightly curved, the sides sometimes slightly irregular in outline, 8.5–10 x 2.4–2.6 μ, 1-celled, lacking oil globules.

Known only from the **type**: On decaying culms of *Phragmites communis* Trin., Weisskirchen, Mahren, Bohemia, May 1914, *F. Petrak* (FH).

Saccardo in his original description indicates that this species is close to *Helotium citrinulum*. Superficially the apothecia of the type (Fig. 6) differ but slightly from those of *H. citrinulum* (Fig. 1) in being less brightly colored than most specimens of the latter and in being slightly grayish on the lower portion of the receptacle. Microscopically the species is distinct from *H. citrinulum* in its wedge-shaped spores (Fig. 9), long and narrow asci (Fig. 8) and different structure (Fig. 7). The hyphae of the medullary excipulum do not stain well, the walls are thin and appear to become confluent, and the tissue contains a large amount of obscuring mineral matter (Fig. 7). It is not certain whether the structure is fundamentally prosenchymatous or pseudoparenchymatous. In contrast, the corresponding region in *H. citrinulum* (Fig. 2) is rather loose and open and the hyphae are distinct. Also in *Pezizella culmigena* (Fig. 7) the ectal layer is more clearly defined, more rind-like, and more compact than in *Helotium citrinulum*, and the outer layer of cells in the basal portion of the apothecium is brown, whereas in *H. citrinulum* the entire tissue is practically colorless. It is possible that the two species are less closely allied than their superficial resemblances would at first indicate.

3. **Helotium midlandensis** sp. nov.

FIGURES 10–13.

Apotheciis sparsis vel subgregariis, plerumque solitariis, rarius trinis vel octonis, stipitatis, flavis vel aurantiacis, 0.3–0.7 mm. in diam. et eaque altitudine; stipite sat gracili, cylindrico, levi, pallide flavo; disco apiriente depressione minuta citoque applanata, subcarnoso, remanente solido in siccis; receptaculo stipiti concolori, in siccis minute-ericeo-striolato de margine usque ad apicem stipitis, levi in humidis; hymenio plano vel patelliformi, rarius leviter convexo, flavo vel aurantiaco; margine levi, obtuso, circulari vel angulato ex pressione marginum aggregatorum attingentium; paraphysibus, simplicibus, interdum unum ramum prope basim gerentibus, cylindraceis, 3–5 septatis, 2.4–3.2 μ in diam.; ascis e "croziers" natis, clavatis, 45–65 x 6.5–6 μ; ascosporis biseriatim vel subbiseriatim dispositis, unicellulatis, plus minusve ovoideis, 7–10x2.6–3.2 μ.

Apothecia known only from dried specimens, scattered to subgregarious, usually solitary, more rarely in clusters of three to eight, stipitate, in general aspect yellow or orange-yellow, 0.3–0.7 mm. across the disc and of about the same height; **stipe** rather slender, cylindric or essentially so, smooth, pale yellow; **disc** opening by a minute depression, very soon plane, subfleshy, retaining its original fullness on drying; **receptacle** concolorous with stipe, when dry showing fine, silky superficial striae radiating from top of stipe toward margin, smooth when moistened; **hymenium** plane to patelliform, more rarely slightly convex, yellow or orange-yellow; **margin** smooth. obtuse, circular, or when crowded becoming angular from mutual pressure; **in section:** *stipe* about 180 μ thick, very compact, composed of narrow, parallel hyphae about 3 μ diam. with narrow lumen and thickened, confluent walls, those near the surface turning outward and ending in a thin indefinite zone 12–18 μ thick and composed of isodiametric cells 3–6 μ diam.; *medullary region* of disc fairly compact, of thin-walled hyphae 2.5–3.5 μ, much branched and interwoven; *ectal layer* compact, 40–50 μ thick, composed of narrow, parallel hyphae 3–4.5 μ diam., except at or near the surface where a few are of somewhat larger diameter and the cells shorter; *subhymenium* not differentiated from the medullary layer; **paraphyses** simple or occasionally once-branched near the base, cylindric, 3–5-septate, 2.4–3.2 μ diam.; **asci** originating from croziers, clavate, 45–65 x 6.5–7 μ; **ascospores** biseriate or subbiseriate, 1-celled, irregularly obovoid, 7–10 x 2.6–3.2 μ.

Habitat: One specimen (Iowa, *Grumbein*) on petioles and larger leaf veins of old leaves of *Quercus* sp.; all others on old pods of *Gleditsia triacanthos* L.

Distribution and specimens examined: **Ohio**: *Morgan 801*, reported incorrectly (Morgan, Journ. Mycol. **8**: 184. 1902; Seym., Host Index, p. 416. 1929) as *Helotium discretum* Karst. (NY-E). — **Iowa**: Homestead, Sept. 26, 1931, *G. W. Martin 5186*, **type** (FH). — Hills, Dec. 3, 1933, *G. W. Martin 5191* (FH). — (With *Typhula juncea*), North Liberty, Oct. 4, 1941, *M. L. Grumbein* (FH). — **Kansas**: Lawrence, 1890, *W. C. Stevens 59*, incorrectly labeled *Helotium herbarum* (NY-E).

This species has much the aspect of *Helotium immutabile* Fuckel and other members of the *H. epiphyllum* group (cf. White, Farlowia **1:** 137, 139–147. 1943) to which it belongs. It is distinguished among these species by its small size, the comparatively slight parenchymatous differentiation of the ectal layer of the disc, small asci, and small egg-shaped spores. Compare the following species.

4. **Helotium erraticum** sp. nov.

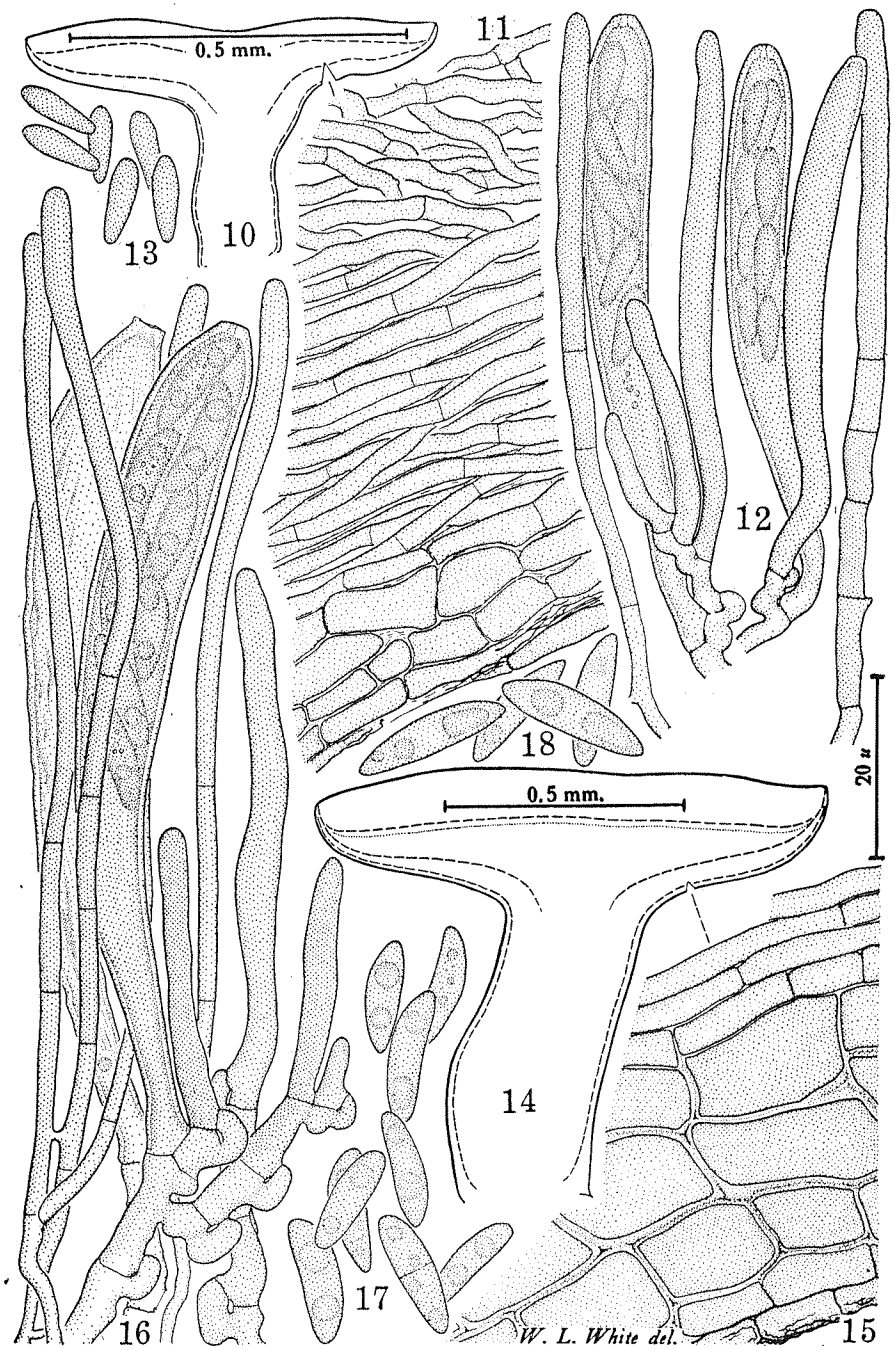
FIGURES 14–18.

Apotheciis paucis, sparsis vel subgregariis, stipitatis, albis vel cremeo-flavis, usque ad 2.5 mm. latis et 1 mm. altis, siccando flavescentibus, cartilagineis; stipite crasso, plus minusve cylindraceo, levissimo, albo-hyalino, lutescente siccando; disco depressione minuta aperto, mox applanato, carnoso, levi, albo, siccando lutescente vel rubescente; hymenio albo, plano, siccando lutescente vel rubescente, opaco vel plus minusve pellucido, cupuliformi; margine levi, obtuso. —Stipite consistente ex hyphis parallelis, densis, 2.5–5 μ crassis, tenuitunicatis, et ad basin et secundum superficiem expositam brevioribus et 4–10 μ crassis, membranis crassiusculis praeditis; excipulo ectali disci indefinito, admodum compacto, ad basin crasso, marginem versus tenuiore, ca. 40–50 μ crasso in parte media inter basin et marginem; regione medullari minus compacta; subhymenio vix distincto a medulla; paraphysibus longis, rectis, simplicibus vel rarissime semel furcatis prope basin, ad apicem clavatis, ascos longitudine paululum superantibus, 2.8–3.5 μ crassis; ascis e "croziers" natis, clavatis, 90–120 x 9–11.5 μ; ascosporis biseriatim dispositis, subtus autem unam tantum seriem formantibus, oblongis vel obovoideis, subcurvatis vel unum ad latus applanatis atque utrinque subattenuatis, interdum plus minusve crepiduliformibus, praecipue cum membrana asci iam compressae sunt, uni-cellularibus, 11–17 x 3.5–4 μ, guttulis olei globulosis conspicuis binis apicalibus instructis. Habitatio: Ad folia putridissima arborum frondosarum.

Apothecia few, scattered or rarely subgregarious, stipitate; when fresh, white to creamy yellow, up to 2.5 mm. diameter and 1 mm. high, more often 0.5–1.0 mm. across the disc, and 0.6–0.8 mm. high; in drying, contracting slightly, becoming yellow or dull reddish yellow, "Chamois" to "Cinnamon-Rufous" or "Orange-Cinnamon," cartilaginous and of more or less the same color and consistency throughout; **stipe** stout, cylindric or essentially so, entirely smooth, hyaline-white when fresh, drying translucent-yellow; **disc** opening by a minute depression, soon plane, fleshy, contracting slightly on drying, more or less saucer-shaped, remaining thick; **receptacle** smooth, when fresh white, drying translucent-yellow below, similar toward the margin or of a brighter and more opaque yellow, or sometimes uniformly yellow or reddish; **hymenium** when fresh white or nearly so, plane, on drying becoming bright yellow

Fig. 10–13, Helotium midlandensis: 10, Diagrammatic representation of section through apothecium, × 110, from type (FH); **11,** Section through ectal excipulum, *Martin 5191,* × 1290 (FH); **12,** Asci and paraphyses, from type, × 1290 (FH); **13,** Ascospores from type, × 1290 (FH).

Fig. 14–18, Helotium erraticum: 14, Diagrammatic representation of section through apothecium, from type, × 78 (FH); **15,** Section through ectal excipulum, from CU-P *27850* (FH); **16,** Asci and paraphyses, from CU-P *29658,* × 1290 (FH); **17,** Ascospores, from CU-P *29658,* × 1290 (FH); **18,** Ascospores, from TRT *17611,* × 1290 (FH).



FIGURES 10–18

to reddish, opaque or more or less translucent, saucer-shaped; **margin** even, obtuse, drying slightly elevated and very slightly undulate or wrinkled; **in section:** *stipe* composed of very compact, parallel hyphae, 2.5–5 μ diameter, thin-walled except at the base and along the exposed surface where the cells are shorter and thicker, 4–10 μ diameter, with walls slightly thickened and confluent; *ectal excipulum* of disc indefinite, very compact, thick at the base, thinner toward the margin, about 40–50 μ thick half way between base and margin, the hyphae similar to those of the stipe, the outermost ones similarly somewhat larger in diameter and with walls slightly thickened, forming a thin rind layer extending nearly to the margin; *medullary region* slightly less compact, of thin-walled hyphae 2.5–5 μ diam., much branched and interwoven in all directions; *subhymenium* scarcely differentiated from the medullary region; *paraphyses* long, straight, unbranched, or very rarely once-branched close to the base, clavate at the apex, extending somewhat beyond the asci, 2.8–3.5 μ diam.; **asci** originating from croziers, clavate, 90–120 x 9–11.5 μ; **ascospores** biseriate above, uniseriate below, oblong or obovoid, slightly curved or flattened on one side, slightly pointed toward the ends, sometimes appearing more or less slipper-shaped especially when crowded in the ascus, 1-celled, 11–17 x 3.5–4 μ, with a conspicuous and rather large oil globule in each end.

Habitat: On much decayed leaves of various frondose trees (as listed below); one collection on old pods of *Robinia Pseudoacacia* L.

Distribution and specimens examined: **Quebec:** On *Acer* sp., *Populus* sp., & sp. indet., Duchesnay, Aug. 25, 1938, *H. H. Whetzel & T. Sproston,* previously reported (Mycologia **31:** 730. 1939) as *Helotium phyllophilum* and (White, Farlowia **1:** 141, 159. 1943) as *H. epiphyllum* (CU-P *27850,* FH). — Duchesnay, Aug. 26, 1938, *R. F. Cain 11154,* reported (Mycologia, l. c.) as *H. immutabile* and (White, l. c., p. 141, 147) as *H. epiphyllum,* spec. comm. H. S. Jackson (FH). — **New York:** On *Acer* sp., Coy Glen, near Ithaca, Oct. 3, 1938, *H. H. Whetzel & W. L. White 3416* (FH). — On *Acer* sp. ?, Coy Glen, Oct. 3, 1938, *Whetzel & White 3421,* **type** (FH). — On *Amelanchier* sp., *Hamamelis* sp., & *Ulmus* sp., Malloryville, near Ithaca, Oct. 18, 1941, *H. H. Whetzel & J. Niederhauser* (CU-P *29658,* FH). — On pods of *Robinia Pseudoacacia* L., Newfield Gorge, near Ithaca, Oct. 26, 1941, *H. H. Whetzel & T. Sproston* (CU-P *29666,* FH). — **Ontario:** On *Acer* sp., Brewer Lake, Algonquin Park, Sept. 5, 1939, *R. F. Cain,* comm. Jackson, TRT *17611* (FH).

This is another member of the *Helotium epiphyllum* group and must be cautiously separated from such species as *H. epiphyllum, H. immutabile, H. carpinicola,* and *H. midlandensis.* These species appear to be distinct and taxonomically satisfactory, but may be somewhat difficult for one who has had no experience with them. They cannot be separated with any degree of certainty macroscopically, but under the microscope are distinct on a number of characters, the final and most important being spore size and shape.

5. **Helotium albidum** (Rob. ex Desm.) Pat., Tab. Anal. Fung. **4:** 173, *fig. 382a–d.* 1885.

Peziza albida Rob. ex Desm., Ann. Sci. Nat. 3: **16:** 323. 1851.
Helotium scutula (Pers. ex Fr.) Karst. var. *albidum* (Rob. ex Desm.) Karst., Myc. Fenn. I, Bidr. Känn. Finl. Nat. Folk **19:** 112. 1871.

Phialea albida (Rob. ex Desm.) Gill., Champ. France, Discom., p. 105. 1879–1883.
Hymenoscypha albida (Rob. ex Desm.) Phill., Man. Brit. Discom., p. 138. 1887.

FIGURES 19–24.

Apothecia arising from black areas 1-several cm. long on the leaf petiole, 6–20 on each such area, scattered to subgregarious, stipitate, in the dried condition up to about 1.2 mm. high and 1.5 mm. across the disc, the larger ones expanding to 2 mm. when moistened, in the fresh condition creamy white or ivory white (Desm.) or with maximum moisture content more dilute in color, drying with stipe and outside of disc essentially concolorous, "Cinnamon" or "Pinkish Cinnamon," and the hymenium "Orange-Cinnamon"; **stipe** cylindric, slender but not delicate, minutely scabrous when dry; disc subfleshy, spreading, saucer-shaped when dry; **receptacle** when dry finely and closely lined with superficial radiating striae; **margin** even, when dry conspicuously elevated above the hymenium; **hymenium** drying firmly waxy; **in section:** *stipe* composed of a broad central core, hyaline, of thin-walled hyphae about 4–6 μ diam., and a thin, yellowish, cortical layer 4–5 cells thick and composed of short rectangular cells; *medullary region* of disc compact, composed of hyphae similar to those making up the central core of the stipe; *hypothecium* not noticeably differentiated; *ectal layer* not sharply distinguished, consisting of a zone about five cells thick made up of large hyphae 8–10 μ or rarely up to 15 μ diam., over which is a thin external covering of narrow more or less crushed or collapsed hyphae of smaller diameter; **paraphyses** simple, usually 3-septate, slightly enlarged toward the apex, about 3 μ diam.; **asci** clavate-cylindric, not originating from croziers, 90–100 x 10–12 μ; **ascospores** uniseriate below, biseriate above, 1-celled, 13–17 x 4–5 μ, rounded above, very slightly tapering toward the lower end, slightly curved or flattened on one side, obtuse-pointed below, the content granular.

On fallen, decaying petioles of *Fraxinus excelsior* in France. Known with certainty only from the material of Desmazières: Pl. Crypt. Fr., ed. 1, *2004;* ed. 2, *1604* (FH).

This is a member of the *Helotium scutula* complex in which many forms, varieties and species have been described. It is being allowed to stand as distinct from *H. scutula* or *H. caudatum,* the former on herbaceous stems and the latter on leaves. It is more robust than *H. caudatum* and differs from both it and *H. scutula* in having spores which are smaller in size and more obtuse at the lower end. If it proves to be confined to *Fraxinus* petioles where it causes blackening, and if spore and other characters are constant, then it may be maintained as a species. The references listed above are only those pertinent to the synonymy. There are many European records, but they are based largely upon spcimens better referred to *H. caudatum* or *H. scutula.*

6. **Helotium scutula** (Pers. ex Fr.) Karst. var. **fucatum** (Phill.) in Rehm *in* Rabenh. Krypt.-Fl. 1^8: 793. 1893. — Massee, Brit. Fung.-Fl. **4:** 254. 1895. — Boud., Hist. Classif. Discom. Europe, p. 114. 1907.

Peziza fucata Cooke & Phill.; Cooke, *nom. nud.,* Grevillea **4:** 132, *pl. 65, fig. 300.* 1876.

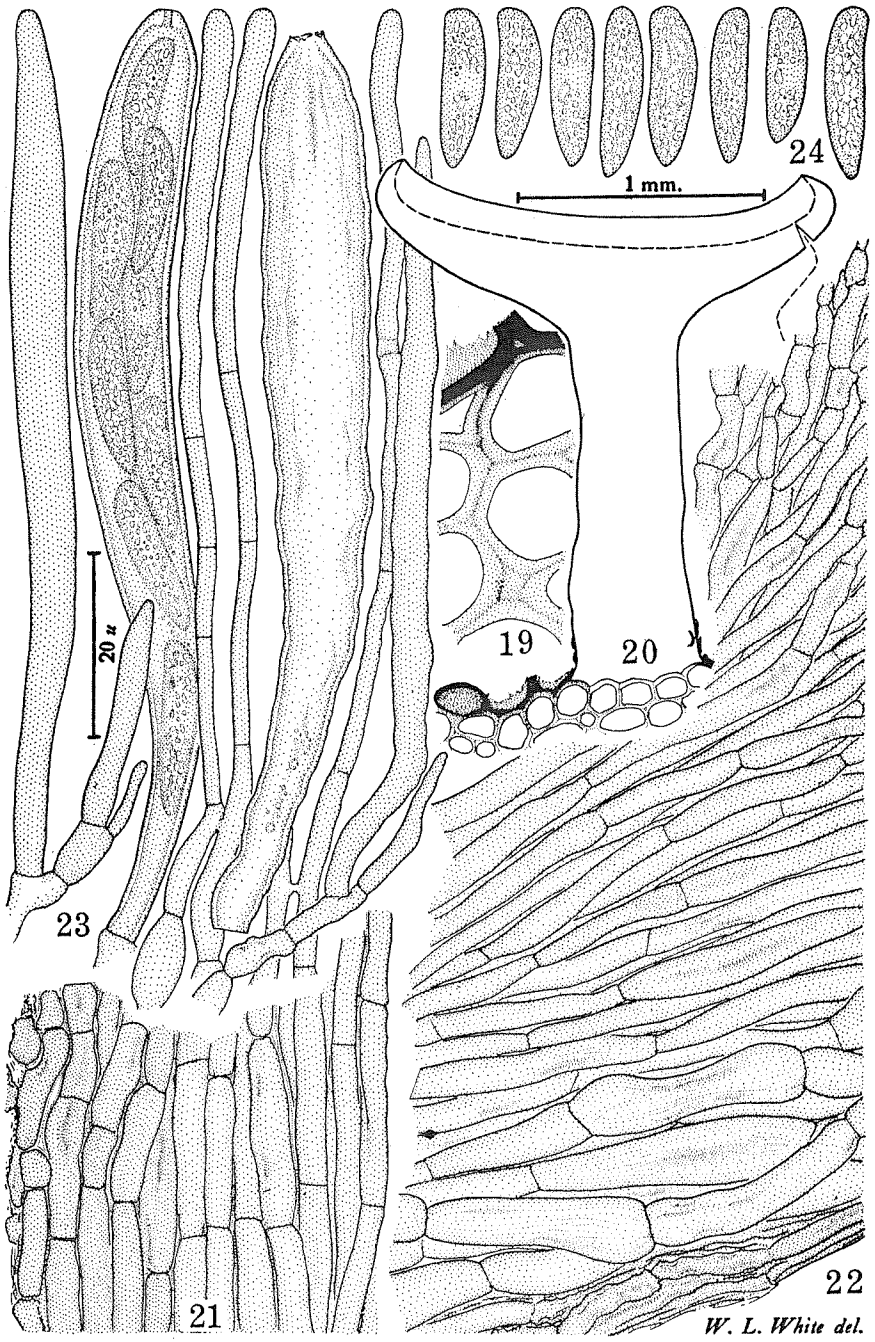
Hymenoscypha scutula (Pers. ex Fr.) Phill. var. *fucata* Phill., Man. Brit. Discom., p. 137. 1887.

Phialea scutula (Pers. ex Fr.) Gill. var. *fucata* (Phill.) Sacc., Syll. Fung. **8:** 266. 1889. — Seaver, Bull. Lab. Nat. Hist. State Univ. Iowa **6**[2]: 101. [Oct. 1911], spec. & descr. excluded. — Oud., Enum. Syst. Fung. **2:** 1004. 1920. — Seym., Host Index, p. 292. 1929, based on Seaver's report (l.c.).

FIGURES 25–30.

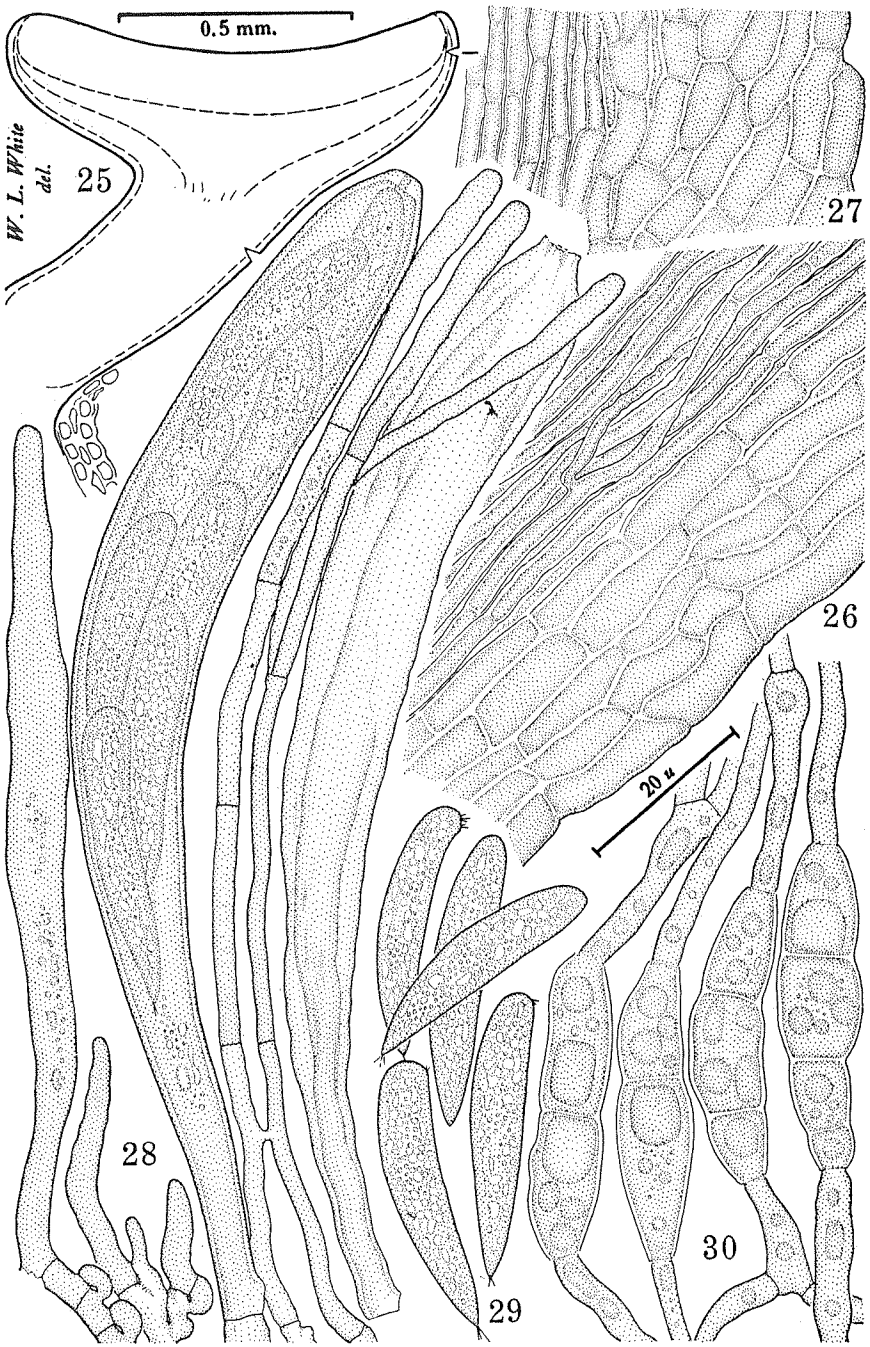
Apothecia scattered to subgregarious, fairly numerous, stipitate, hyaline-white when fresh, or sometimes yellowish-stained, 1–3 mm. high, up to 2.8 mm. across the disc though usually smaller, drying yellowish ochraceous, all parts approximately concolorous in both fresh and dried conditions, the disc contracting somewhat in drying, usually not over 1 mm. diam. in herbarium specimens; **stipe** slender, usually about equalling the diameter of the disc, originating underneath the epidermis of the substratum, scarcely noticeably erumpent, smooth, usually more or less broadened at juncture with disc; **disc** at first subglobose, opening by a pore, finally expanding, more or less saucer-shaped, of medium thickness; **receptacle** smooth when fresh, very minutely radiately furrowed when dry; **hymenium** becoming plane at maturity and with maximum moisture content, drying slightly to pronouncedly concave; margin thick, obtuse; **in section:** stipe with a rind about 30 μ thick or about 5–6 cells thick, composed of longitudinally parallel hyphae 4–8 μ diam. divided into rectangular cells 13–19 μ long with walls slightly thickened and confluent, this rind enclosing a large central core of parallel, compact hyphae 2.5–3.5 μ diam. with walls slightly thickened, divided into cells 25–50 μ long; *disc* composed of an ectal layer of hyphae similar to those of the stipe and a relatively reduced medullary region of more loosely interwoven hyphae; *ectal layer* about 50 μ thick at the base, becoming thinner toward the margin, consisting of an outer zone similar to that of the stipe and a broader inner zone of radiately parallel hyphae similar to those of the central part of the stipe; paraphyses simple or frequently once or twice branched at or more often below the middle, usually near the base, 3–5-septate, slightly clavate at the apex and there 3–3.5 μ diam.; **asci** originating from croziers which break rather easily, clavate, 118–135 x 12–15 μ; **ascospores** biseriate, 1-celled, obtuse and rounded above, flattened on one side or slightly curved, narrowed downward, acute at the lower end, 24–34 x 5–6.8 μ, each end beset with 1 to several small, inconspicuous cilium-like processes, content with numerous conspicuous refractive granules.

Known from only three collections: **New York:** On old stems of *Polygonum robustius* (Small) Fernald (det. Fernald) lying in film of water in swamp, Cayuta



FIGURES 19–24

Fig. 19–24, Helotium albidum, all from **type** material, Desm. Pl. Crypt. Fr., Ed. I, *2004* (FH): **19,** Diagrammatic representation of section through an apothecium, × 40; **20,** Section showing blackening of the exposed cell walls over the area of the petiole on which the apothecia are seated, the epidermis of the petiole having earlier sloughed off, × 1290; **21,** Section showing structure of outermost tissue of stipe, exposed surface at left, taken from near but not at the base, × 1290; **22,** Section showing structure of disc tissue, × 1290; **23,** Asci and paraphyses, × 1290; **24,** Ascospores, × 1290.



FIGURES 25–30

Lake, Sept. 1, 1936, *H. H. Whetzel & W. L. White* (CU-P *25494*, FH, US). — Same substrate and locality, Sept. 9, 1938, *Whetzel, White, et al* (CU-P *27863*, FH, US). — **England:** "On dead stems of *Polygonum* lying in water.", Shrewsbury, Phill. Elv. Brit. *120*, **type** (CU-PD *11122*, FH).

It would be scarcely possible for three collections to agree more completely than do those cited above. Although the substratum for the British specimen is insufficient for complete identification, there is no doubt about its being *Polygonum*, and the pieces of stem in the packets agree so closely with those of the American collections that one is tempted to guess that they represent a closely allied species. The evidence is that this fungus does exist as a distinct entity within the taxonomically difficult *Helotium scutula* complex of which it is a member. Its distinguishing characteristics are the presence of croziers at the bases of the asci, relatively large asci, large and robust spores, and occurrence on decaying, water-saturated stems of *Polygonum*. Though this variety may prove to be confined to *Polygonum*, this does not mean, however, that all members of the *Helotium scutula* group found on *Polygonum* should be referred here. On the contrary several collections are at hand where the substratum is *Polygonum* and the fungi are typical *Helotium scutula*. A specimen on *Polygonum* from Iowa (CU-PD *553*), reported by Seaver under the varietal name, represents typical material of the species.

Cultures were made from both of the American collections, using mass ascospore discharge on potato dextrose agar. The spores germinated readily, becoming 1–3 septate in the process, and developing a mat of sterile mycelium. The cultures were maintained only in test tubes at room temperature, but there developed no conidial stage, spermatia, stromata or other structures of taxonomic value.

7. **Helotium Dearnessii** (Ell. & Ev.) White, Mycologia **34**: 167. 1942.
   Peziza (Phialea) *Dearnessii* Ell. & Ev. nom. nud., N. Am. Fungi, second series *2624*. 1891.
   Phialea Dearnessii Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia **1893**: 146. [Feb. 28] 1893. — Sacc., Syll. Fung. **11**: 403. 1895. — Seym., Host Index, p. 558, (559 from error in host det.). 1929. — J. H. Miller, Pl. Dis. Rep. Suppl. **131**: 47. Aug. 15, 1941, based on an incorrect determination.
   Hymenoscypha Dearnessii (Ell. & Ev.) Kuntze, Rev. Gen. Pl. **3**^{2}: 485. 1898.

FIGURES 31–34.

Apothecia scattered to subgregarious, not crowded, appearing sessile or nearly so, in the dried condition ochraceous, all parts concolorous 0.3–0.7 mm. diam. across the disc, when moistened becoming more yel-

Fig. 25–30, Helotium scutula var. **fucata,** all except fig. 30 from Phill. Elv. Brit. *120*, **type** (FH): **25,** Diagrammatic representation of section through apothecium, × 76; **26,** Section showing structure of outermost tissue of stipe, × 1290; **27,** Section showing structure of outermost tissue of disc, × 1290; **28,** Asci and paraphyses, × 1290; **29,** Ascospores, × 1290; **30,** Ascospores germinated on potato dextrose agar, slightly more than × 1290 (CU-PD *25494*).

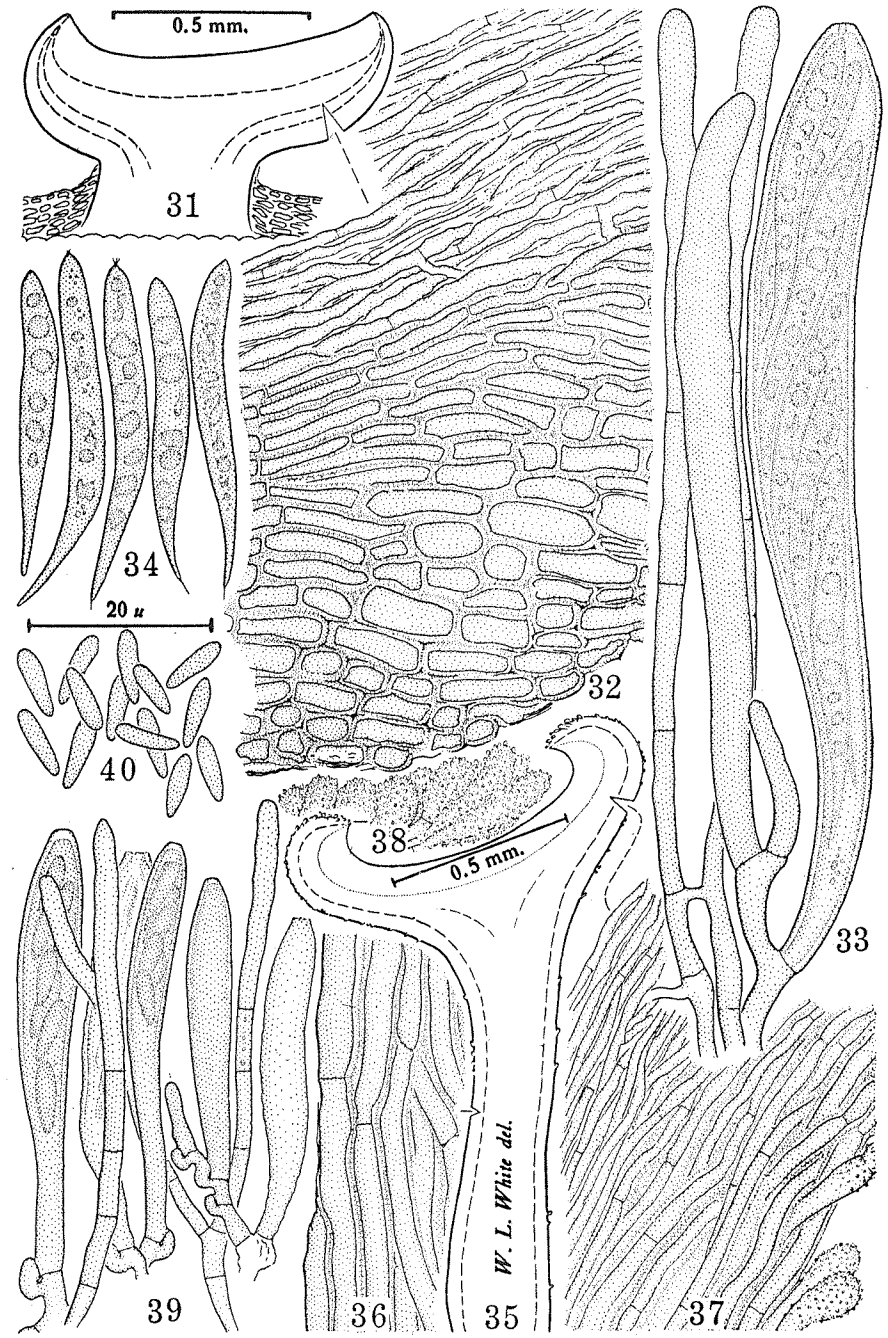
lowish the largest reaching as much as 1.0 mm.; **stipe** obscure, scarcely long enough to raise the central part of the disc off the substratum, rarely longer, ochraceous, rarely darker at the base; **disc** rather fleshy, saucer-shaped when dry, becoming cushion-shaped when moistened; **receptacle** smooth; **hymenium** opening by a minute depression, soon plane, remaining plane or becoming somewhat concave on drying, convex when moistened; **margin** even, slightly elevated when dry, when moistened expanded and recurved, wedge-shaped; **in section:** *stipe* originating underneath the cortex of the host, erumpent, cylindric, usually protruding only slightly beyond the cortex, very compact, homogeneous; *ectal layer* of disc thick, indefinite, in general composed of an inner layer originating at the top of the stipe, about 40 μ thick at the base, tapering towards the margin, colorless, composed of compact parallel hyphae about 3 μ diam. with walls scarcely or not at all thickened, these hyphae turning obliquely outward to form a thicker outer brownish zone and there becoming somewhat larger, shorter-celled, with walls thickened and confluent; *medullary region* thin, rather loose, the hyphae rather narrow, thin-walled, interwoven, becoming erect towards the hymenium; *hypothecium* not differentiated from medullary layer; **paraphyses** mostly simple, rarely once-branched below the middle, gradually enlarged from base to apex, about 3–3.5 μ diam. at apex; **asci** not originating from croziers, clavate, 100–108 x 9–13 μ; **ascospores** biseriate, elongate, pointed at the ends, attenuate below, 1-celled, containing a row of 2–9 oil globules, with a delicate cilium 2.5–3.5 μ long at the lower end, sometimes also at the upper end, 30–35 x 4–4.5 μ not including the cilia.

Known only from the following collections: **Quebec:** On old herbaceous dicotyledonous stems, Aug. 25, 1938, *J. W. Groves* (FH, OTB). — **Ontario:** On old stems of *Steironema ciliatum* (L.) Raf., London, May [24], 1890, *J. Dearness 1713*, **type** (FH-E). — Additional material from same place, June [13], 1890, *J. Dearness 1713*, Ell. & Ev. N. Am. Fungi, 2nd ser. *2624* (FH).

According to a letter from Dearness to Farlow, he first collected the species May 24, 1890 and recorded the substrate as *Monarda didyma*. Ellis described it as on *Monarda* and it was so recorded in Seymour's Host Index. Dearness apparently returned to the same place June 13, 1890, collected additional material which he sent Ellis for his N. Am. Fungi, and decided that the host was *Steironema ciliatum*. A very ample portion of the June 13th material, in addition to the portion in N. Am. Fungi, was sent to Farlow and is now in the Farlow Herbarium.

Fig. 31–34, Helotium Dearnessii, all from Dearness, *1713*, coll. June 1890 (FH); **31,** Diagrammatic representation of section through apothecium, × 64; **32,** Section showing details of structure of ectal excipulum, × 1290; **33,** Asci and paraphyses, × 1290; **34,** Ascospores, × 1290.

Fig. 35–40, Helotium gemmarum, all from CU-P *25181* (FH): **35,** Diagrammatic representation of section through an apothecium, × 60; **36,** Section showing structure of outer layer of stipe, × 1290; **37,** Section showing structure of medullary and ectal layers of disc, × 1290; **38,** Hyphal tips from margin of disc, × 1290; **39,** Asci and paraphyses, × 1290; **40,** Ascospores, × 1290.



FIGURES 31–40

The collection recorded by Miller (l. c.) from Georgia on *Steironema ciliatum*, of which he kindly loaned me a fragment, proves to be the much more common and widespread species, *Helotium scutula* (Pers. ex Fr.) Karst., to which *H. Dearnessii* is surely closely related but clearly distinct in its long, attenuate spores.

The two specimens of *Helotium Dearnessii* recorded above agree closely in their characters except that in the Ontario material the apothecia are all so short-stipitate that on superficial examination they appear sessile, whereas in the Quebec specimen most of them are distinctly stipitate; also the cilia, which are difficult to see in the former are rather distinct in the latter.

6. **Helotium gemmarum** Boud., Bull. Soc. Myc. France **4**: 81, *pl. 17, fig. 2.* 1888. — Boud., Rev. Myc. **11**: 167. 1889. — Boud., Icones Mycol. **3**: *pl. 493.* 1905–1910. — Boud., Hist. Classif. Discom. Europe, p. 112. 1907.

Phialea gemmarum (Boud.) Sacc., Syll. Fung. **8**: 271. 1889. — Oud., Enum. Syst. Fung. **2**: 61. 1920. — J. H. Miller, Pl. Dis. Rep. Suppl. **131**: 47. 1941.

FIGURES 35–40.

Apothecia scattered to subgregarious, small, delicate, slender, stipitate, white, in the fresh condition up to 1.5 mm. high (up to 5.0 mm. fide Boud.) and 0.4–1.4 mm. across the disc; **stipe** slender, slightly enlarged upward, when fresh hyaline to dilute white, smooth at the base, minutely puberulent above, not changing perceptibly on drying; **disc** opening by a pore, at first infundibuliform, at length expanding, finally plane, thin, on drying quickly contracting to become more or less funnel-shaped with margin turned inward; **receptacle** minutely and sparsely puberulent, dilute white when fresh, remaining so on drying or varying towards dingy cream-color; **hymenium** always about same color as receptacle, flat at full maturity and with maximum moisture content, otherwise more or less deeply concave; **margin** minutely puberulent, even with the hymenium in fresh, mature specimens, erect or turned inward in dried material; **paraphyses** not numerous, simple or more rarely once-branched below the middle, not enlarged at the apex; **asci** small, cylindric, clavate, 45–50 x 5–7 μ; **ascospores** small, obpiriform, 6–9 x 2.5–3 μ.

Habitat: Appearing in early spring on the scales of buds of various species of *Populus* (listed below) which had fallen the previous season and lodged under and among debris on wet ground.

Distribution and specimens examined: **New York:** On *P. candicans* Ait., Lloyd Preserve, McLean, Apr. 26, 1936, *H. H. Whetzel, D. H. Linder, & W. L. White* (CU-P *25181*, FH). — On *P. candicans*, Lloyd Preserve, McLean, May 2, 1937, *W. L. White et al* (FH). — On *P. candicans*, Lloyd Preserve, McLean, May 18, 1940, *H. H. Whetzel, W. L. White, & J. Niederhauser* (CU-P *29086*, FH). — **Pennsylvania:** On *Populus* sp. ?, May 5, 1935, *H. H. Whetzel* (FH). — **Georgia:** On *P. deltoides* Marsh., Agricultural Campus, Athens, Apr. 29, 1940, *J. H. Miller* (GA *583*). — **France:** Type locality. Boudier indicated that it was frequent on the old bud scales of *Populus nigra* L. in the vicinity of Paris in February. Notes and drawings by Massee, made from Boudier material, are in the New York Botanical Garden but are not accompanied by a specimen.

There appears to be no European material of this species available in the herbaria of this country. However, it is well marked as to morphological characters, substratum, and season of occurrence. Comparison of North American specimens with the illustrations of Boudier leaves no reason for doubt as to its identity. Two other species with similar characteristics — white, slender, with small spores, occurring in the spring in moist habitats — and possibly more or less closely related, are *Phialea Cassandrae* Kanouse, occurring in Michigan on the leaves of *Chamaedaphne calyculata* (L.) Moench (see White, Farlowia **1**: 159. 1943), and *Helotium amenti* (Batsch ex Fr.) Fuckel (see Boudier, Icon. Mycol., pl. *496.* 1905–10), of widespread occurrence on female catkins of *Salix* sp.

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