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Geoglossaceae Notebook 1

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The Geoglossaceae of North America

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The Geoglossaceae form a group of discomycetous fungi usually associated with the helvellas and morchellas. In the system proposed by Boudier the family is widely removed from the above groups, falling in the Inopercules, associated with plants of the Helotium- and Mollisia-type, in which the ascus opens by a pore. In my opinion the latter is the more natural position.

The Geoglossaceae include plants of two general types of form. The Geoglosseae are mostly club-shaped or clavate in outline, the asci arising directly from the surface of the clavula and forming a uniform stratum over it. They remind one strongly of the simple clavarias. The Cudonieae, on the other hand, are mostly pileate, the upper or superior surface being ascigerous, and the lower or inferior one sterile. The single sessile genus Apostemidium forms a connecting link between this group and the Mollisiaceae.

In the great majority of species the hymenium covers only a part, usually the upper portion of the ascoma. In Gloeoglossum, however, especially in G. difforme(Fr.) Durand, while most of the asci are at the upper end of the club, the whole surface is potentially ascigerous. The paraphyses cover the entire ascoma, and scattered asci may be found among them even at the very base of the club. In the other two species of the genus the distinction between ascigerous portion and stem is more marked. Although the paraphyses cover the entire stem to its base I have not yet detected asci among them.

Most of the species are plants of fleshy consistency, but usually elastic or fibrous rather than brittle. A few like Cudonia are distinctly leathery in texture, while others are decidedly gelatinous. Saccardo has placed the leotias in the Bulgariaceae on this account, but other undoubted members of the family, notably the gloeoglossums, are distinctly gelatinous when fresh. The vibrisseas and apostemidiums are rather soft and semigelatinous as would be expected from their peculiar habitat.

The plants of this familyare composed almost entirely of hyphae. In some genera(e. g. Geoglossum) these are stout, more or less parallel and rather closely septate. In longitudinal section such tissues look like a pseudoparenchyma. In others (e. g. Leotia) the threadsare slender and more loosely interwoven. Mr. Massee would limit the family to species formed entirely of hyphae, but this criterion would exclude the cudonias and vibrisseas in which there is a distinct pseudoparenchymatous cortex.

Geoglossaceae

In Spathularia and Cudonia it is not unusual to see asci which are filled with small, elliptical, spore-like bodies strongly suggestive of the condition in Tympanis, Biatorella and other genera ~~of~~ with "polysporous" asci. One does not need to look far to find the origin and nature of these bodies. One rarely makes a preparation of one of these genera without seeing ascospores to the sides of which numerous little bodies are attached by short lateral processes. This condition is exactly comparable with that observed in many ascomycetes, in which the ascospores on germination put forth very short germ-tubes which immediately begin to throw off secondary conidia. In the case of Cudonia and Spathularia the spores germinate while still within the ascus, and the conidia are produced until the ascus is completely filled and the original ascospores obliterated.

The question of the origin of the hymenium in the Geoglossaceae is of much interest. Until quite recently it has been supposed that the hymenium was not covered by any special membrane as in the other discomycetes, but was free and exposed from its youngest stages. Schroeter made this condition the distinguishing character of the Helvellineae. The first definite evidence to the contrary was presented by Dr. Gustav Dittrich, based upon an examination of young ascomata of Mitrula phalloides and Leotia gelatinosa(L. lubrica). His observations showed that in both species the young hymenium is at first completely enveloped by a special membrane comparable to the volva of the Agaricineae, so that the hymenium in these plants is endogenous in its origin rather than exogenous as had been previously supposed.

Observations of my own on several different species, point unmistakeably to the same conclusion. Sections of Mitrula phalloides made from ascomata as small as 1 mm. in height show a distinct veil, composed of slender interwoven hyphae, which are of the same character as those forming the ectal layer of the stem, a nd directly continuous with them. The membrane disappears early by breaking up into fragments, so that it must be studied in the very youngest plants.

Microglossum viride is a more favorable species for study. The veil, although best seen in young ascomata, has been observed covering an ascigerous portion 4 mm. long. In this species as well the hyphae composing the veil are continuous with and of the same character as those of the ectal layer of the stem. Moreover, it is studded with lumps or squamules exactly similar to those borne on the surface of the stem. While the veil seems to break up into fragments there are indications that the hymenium first appears through a pore at the apex.

The most conspicuous veil by far is seen in Cudonia lutea and Spathularia velutipes. In both species it persists until the plants are one-third or even one-half grown, when it cracks into irregular scales and falls away. In the fresh mature plant

one can usually detect its irregular free edge at the line of junction of the stem with the hymenium. In both species the veil is continuous with the ectal layers of the stem, and bears on its surface the roughenings characteristic of the surface of the stem. In Cudonia these cause it to appearfarinaceous, while in the Spathularia the whole young plant is velvety from the projecting bay-brown hairs. In the latter the veil appears to rupture first by a crack running around the plant just above the stem. The contrast in color between the bay-brown surface and the ochraceous hymenium beneath is very pretty and conspicuous.

Whether this veilis present in all members of the family can be determined only by examination of a large number of species in the young state. Sections of quite young ascomata of Geoglossum glabrum, Gloeoglossum difforme and Trichoglossum velutipes have shown no traces of such a membrane. Since, h owever, it has been demonstrated in five genera, representing both sections of the family, viz. Mitrula, Microglossum, Spathularia, Leotia and Cudonia, it seems probable that it will be found in all when they shall be examined in the proper state of development. The following quotation from Phillips would seem to indicate that in Vibrissea, too, the hymenium is not free from the first: " When a plant of Vibrissea truncorum is approaching its maturity the hitherto cylindrical stem begins to enlarge at the summit, and the cortical tissue opens at a point in the center, through which the paler medullary tissue may be seen forcing its way to the light, preparing to give rise to the hymenium". I believe that when the development of the discomycetes shall be better understood it will be found that in none of them, not even in the Helvellaceae, is the hymenium exposed from the first."

The majority of the Geoglossaceae grow in damp or moist situations, and are to be found mostly commonly in low wet woods or swamps or on the shady slopes of ravines. The character of the substratum inhabited varies, of course, with the species. It is possible however, to indicate the following general kinds of substratum together with the species which grow most commonly or most luxuriantly upon them.

1. Rotten wood, logs, stumps etc., usually much decayed. Microglossum rufum, M. fumosum, Gloeoglossum difforme, Geoglossum glabrum, G. alveolatum.

2. Soil covered with rich humus, decaying moss, leaves etc. Microglossum longisporum, M. olivaceum, Corynetes atropurpureus, Gloeoglossum glutinosum, species of Trichoglossum, Leotia lubrica, L. stipitata.

3. Sandy or loamy soil usually without humus. Microglossum viride, Leotia chlorocephala, Geoglossum fallax, Corynetes arenarius, Also Leotia lubrica and L. stipitata.

4. Soil under coniferous trees, covered with needles etc. Mitrula irregularis, Gloeoglossum difforme, species of Spathularia.

5. Dead wood, leaves, moss etc., wholly or partly submerged in water. Mitrula phalloides, the species of Vibrissea and Apostemidium.

6. Dead beech leaves not much decayed. Cudonia lutea.

7. Dead coniferous leaves. Mitrula cucullata.

8. Living moss. Mitrula gracilis and M. muscicola.

As is the case with other fleshy fungi Geoglossaceae vary in abundance with the character of the season. They reach their highest development both in numbers and luxurience in seasons of prolonged rainfall. But this is not the only factor. The species have a strange way of being abundant throughout one season, but almost entirely absent the next, although weather conditions may seem to be the same. Why this is so cannot be explained until more is known about the life history of these plants, and about the conditions affecting their growth and development. Some species as Microglossum viride may be found in the same spot year after year.

Geoglossaceae seem to be most abundant in the states east of the Mississippi River.

It has already been stated that most of the fungi now included in the Geoglossaceae were formerly placed in the large genus Clavaria. In 1794, Persoon described the four genera Mitrula, Leotia, Geoglossum and Spathularia. Since then groups have been split off from time to time, principally from Leotia and Geoglossum, until now more than a dozen genera are recognized which range from the arctic regions to the tropics.

Synopsis of Genera

A. Ascoma stipitate, clavate or spathulate, the ascigerous portion usually more or less compressed, rarely sub-globose.....Geoglosseae.
  B. Clavate, the ascigerous portion not or only slightly decurrent on opposite sides of the stem.
    c. Spores small, elliptical, cylindrical or fusi-form, continuous. Plants bright colored.....1. Mitrula
    C. Spores long-elliptical to cylindrical, 3-many-septate when mature.
      D. Ascomata bright colored.....2. Microglossum
      D. Ascomata black or blackish.
        E. Spores hyaline(cfr. Ge. alveolatum)..3. Corynetes.
        E. Spores fuliginous or brown.
          F. Hymenium without spines or setae.
            G. Ascomata viscid-gelatinous; paraphyses continued down the stem.....4. Gloeoglossum.
            G. Ascomata not viscid-gelatinous; paraphyses confined to the hy-menium.....5. Geoglossum.
          F. Hymenium beset with spines or setae ....6. Trichoglossum.
  B. Spathulate or fan-shaped, ascigerous portion decurrent on opposite sides of the stem.....7. Spathularia
A. Ascoma stipitate, pileate (or sessile in one genus with filiform spores).....Cudonieae.
  H. Spores elliptical-fusiform, ascoma gelatinous..8. Leotia
  H. Spores filiform or filiform-clavate.
    I. Ascoma fleshy-gelatinous, asci very narrow, spores filiform; plants aquatic or semiaquatic.
      J. Stipitate.....9. Vibrissea.
      J. Sessile or turbinate.....10. Apostemidium
    I. Ascoma fleshy-leathery, asci broadly clavate, spores filiform-clavate; plants terrestrial...11. Cudonia

1. Mitrula

Ascoma fleshy, erect, stipitate, clavate, the hymenium covering only the upper portion, or the ascigerous portion* elliptical to subglobose, usually sharply delimited from the stem and often slightly free from it below, bright colored(usually yellow or brownish); asci clavate-cylindrical, opening by a pore; spores,8, uniseriate or biseriate in the ascus, elliptical to narrowly fusiform, hyaline, continuous or rarely 1-septate when mature; paraphyses present or absent.

Author limits the genus to species having the small spores elliptical to fusiform and continuous or rarely, in some species, 1-septate at maturity.

A. Spores broadly elliptical; paraphyses absent.
  B. Ascomata very irregular and contorted; spores 6-10 x 4-5 u.....1. M. irregularis.
  B. Ascomata regularly clavate; spores 4-6 X 3-4 u..... ..2. M vitellina
A. Spores narrowly elliptical, clavate or fusiform; paraphyses present.
  C. Ascigerous portion vitelline yellow, stem satiny white..... .....3. M. phalloides
  C. Ascigerous portion cream-color to brownish, stem darker, at least not white.
    D. Growing on coniferous leaves; ascigerous portion cream-buff when fresh, stem darker,.....4. M. cucullata.
    D. Growing on living moss.
      E. Hymenium nearly even; when dry ascigerous portion orange-brown, stem paler.....5. M. gracilis
      E. Hymenium more or less convoluted.. .....6. M. muscicola.

"Geoglossum irregulare
Mitrula vitellina
" luteola
" crispata
sprague's americana

1. Mitrula irregularis(Peck) Durand.

Plants usually cespitose rarely solitary, clavate, of irregular form, usually twisted or contorted, compressed, obtuse, sometimes lobed, 1.5-5 cm. high; ascigerous portion vitelline yellow, commonly occupying 1/2-2/3 the total length, up to 15 mm broad; stem tapering downward, satiny white, pruinose, fibrillose or thinly tomentose, up to 1.5 cm. high, 2-5 mm. thick, sometimes absent; substance yellowish white. Asci clavate-cylindrical, the ascigerous hyphae repeatedly branched below, apex rounded, not or slightly blue with iddine, variable in lenght, 90-150x5-6 u; spores 8, uniseriate, hyaline, continuous, smooth, elliptical, often slightly reniform, 6-10x4-5 u(majority 8x5); paraphyses absent.

On bare soil, mossy damp ground, or most often among pine leaves; September-November. Ontario and New Brunswick south to District of Columbia. Most common in the coniferous woods of northern New England and eastern Canada.

M Mitrula irregularis may be easily mistaken for a yellow Clavaria, especially C. pulchra Pk., and it has probably often been overlooked on this account. The name is very appropriate as the plants are extremely variable and polymorphic, so that it is scarcely possible to find any two alike. One may see in a single clump individuals with elongated stems associated with others absolutely sessile.

2. Mitrula vitellina (Bres.) Sacc.
Geoglossum vitellinum Bres.
Microglossum vitellinum

Plants clavate, 2-3 cm. high, "when fresh creamy yellow", when dry yellowish cream-color or brownish in one specimen, ascigerous portion occupying about 1/2 the total length, about 3 mm. wide, compressed, obtuse, not sharply differentiated from the stem; stem terete, somewhat flexuous, equal, about 1 mm. diam., whitish fibrillose. Asci slender, cylindrical, branched below, apex rounded, not blue with iodine, 75-80 x5-6 u; spores 8, uniseriate, hyaline, continuous, smooth, broadly elliptical, 4-6 x3-4 u. Paraphyses absent.

On rotten wood, Rugby, Tennessee.

I have referred this collection to M. vitellina in spite of the "creamy" color of the fresh plant and the habitat on "rotten wood). These are small, regularly clavate plants quite different in general appearance from those of the polymorphic M. irregularis. The asci are shorter, are repeatedly branched below, and no paraphyses are present. The spores also are smaller. The spores are not much more than half as large as those of M. irregularis.

3. Mitrula phalloides (Bull.)
? Helvella laricina
Clavaria phalloides
Mitrula paludosa
Leotia uliginosa
Leotia elegans
Mitrula elegans
Mitrula laricina

Type: European, probably no longer in existence.

Plants solitary or usually more or less densely gregarious, sometimes as many as 15-20 closely aggregated and coheri ng at their bases, 2-6 cm. or more high, ascigerous portion clear vitelline yellow, sharply differentiated from the stem, at first solid becoming vesiculose or inflated and hollow when old, in outline elliptical, elliptical-obovate or piriform, apex rounded, obtuse, even or somewhat longitudinally furrowed especially below, often somewhat compressed, rarely more than 1/5 the total height of the plant, 0.5-2 cm. high, 4-10 mm. wide; stem terete, often flexuous, pure satiny white or sometimes with a pinkish tint, 1.5-2mm. thick, smooth, when moist translucent and viscid. Whole plant soft and subtremellose. Asci clavate, apex much narrowed, acute, very slightly blue with iodine, long stipitate, 60-150 x 6-8 u; spores 8, biseriate, hyaline, continuous,smooth, contents granular, cylindrical to clavate-cylindrical, 10-18 x 2.5-3 u; paraphyses filiform, usually branched, septate, scarcely thickened above.

On decaying vegetation often on or among sphagnum, in wet places, pools and ditches; April-June. Ontario to Alabama west to British Columbia.

A very pretty and characteristic species well known by the white, smooth stem, vitelline yellow head, and small elongated spores. When fresh the plant is very soft and delicate often almost tremellose. The ascomata are usually attached by a thin white tomentum at the base of the stem. I have seen no divided spores in this species, but Massee says they often become 1-septate at maturity. The stem is composed of a fascicle of hyphae about 20 u thick. Those at the center are looser and finally break down leaving it hollow. The surface is covered with a thin gelatinous layer, the loose componenthyphae of which are 5 u think. The colors are not entirely lost if the plant is carefully dried, but otherwise it becomes a rather uniform dingy yellowish brown.

4. Mitrula cucullata (Batsch) Fries
Elvella cucullata Batsch.
Mitrula Heyderi Pers.
Leotia Mitrula Pers
Heyderia cucullata(Batshh)Boud.
Type: European, probably no longerin existence.

Plants small, solitary or gregarious, very slender, 1-2.5 cm. high; ascigerous portion elliptical, ovate or obovate, rounded above, distinct from the stem below and free from it for a slight distance, scarcely compressed, 1-3 mm. long, 0.5-2 mm. thick; cream-color to yellowish ochraceous; stem terete, equal or tapering slightly upward, yellowish brown above, darker below, granular pruinose, the lower end frequently enveloped in and attached by a yellowish brown tomentum, 0.5-0.75 mm. thick. All parts become slightyl darker in drying. Asci clavate, apex narrowed, the pore blue with iodine, 45-70 x6 u; spores 8, obliquely uniseriate or biseriate, hyaline, ~~contin~~ continuous, smooth, narrowly fusiform, straight or curved, 13-16 x 2-3 u; paraphyses rather stout, gradually thickened upwards, septate, brownish, 3-4 u thick.

On fallen leaves of conifers; August-September. North-eastern United States.

A minute species, well marked by its color, small size, slender habit, and the habitat on coniferous leaves. The plants are so small as to be easily overlooked, so that the species is probably much more widely distributed in our coniferous forests than the records indicate.

5. Mitrula gracilis.Karst.
Mitrula gracilis var. flavipes Pk.

Plants solitary, slender, 1-1.5 cm. high; ascigerous portion obovate-globose, rounded above, not or very slightly free from the stem below, about 1 mm. diam., orange brown, even or nearly so; stem slender, flexuous, 0.5-0.75 mm. thick, smooth, pale brownish yellow, nearly translucent. Asci clavate, apex rounded, pore blue with iodine, 65-80 x 6~~0~~8 u; spores biseriate, hyaline, smooth, oblong-fusiform to fusiform, continuous or possibly becoming 1-septate, 10-14 x 2-3 u; paraphyses filiform 1.5-2 u thick.

Attached to and evidently parasitic on Paludella squarrosa, in bogs; March(?)-September. Labrador(NY), Newfoundland(A)(D) Reported also from Greenland by Rostrup. Arctic and subarctic regions.

6. Mitrula muscicola P. Henn.
Type: Probably at Berlin, from Norway.

Plants caespitose, erect; pileus yellowish to tan-colored, obtuse, slightly Morchella-like, with a tendency to be ribbed or rugose, glabrous, about 4 mm. long; stipe lighter colored to whitish, glabrous, solid, about 10 mm. long. Asci clavate, apex narrowed, pore blue with iodine, 65-75 x6-8 u; spores 8, biseriate, hyaline, coninuous, smooth, narrowly oblong-elliptical, 10-13 x 2-3 u. Paraphyses filiform, very slightly thickened upward, hyaline, 2 u thick.

On moss stems(Webera nutans), in moist spruce and balsam woods at about 7000 feet elevation, Laggan, Alberta, Aug. 1903. Miss D. Hone. I have tried in vain to see an authentic specimen of M. muscicola.

2. Microglossum Gill.Disc. Fr.
Helote Hazsl. M. T. Akad. ert. A. Termes.
Geoglossum subg. Leptoglossum Cke.

Ascoma fleshy, erect, stipitate, clavate, ascigerous only in the upper portion, bright colored(usually yellow, brown or green); asci clavate-cylindrical, opening by a pore; spores 8, biseriate, hyaline, smooth, elliptical, fusiform or cylindrical, becoming 3-many-septate; paraphyses present.

Plants with the general form and habit of Mitrula or Geoglossum, but always light colored, never black, and the spores several septate at maturity. The typical species is M. viride (Pers.) Boud.

A. Paraphyses strongly curved or uncinate and slightly thickened at the tips.
  B. Spores of one kind in the ascus.
    C. Ascomata bright yellow.....1. M. rufum.
    C. Ascomata yellowish-clay or tawny...2. M. fumosum.
  B. Spores of two kinds in the ascus, the larger 60-100 u long, 14-16 septate; ascomata cinnamon-brown..... .....3. M. longisporum.
A. Paraphyses straight or flexuous; ascomata usually with a greenish tint.
  B. Stem smooth, fibrous.....4. M. olivaceum.
  D. Stem squamulose, scarcely fibrous...5. M. viride.

1. Microglossum rufum (L. v. S.) Underw.
Geoglossum rufum L. v. S.
Clavaria contorta L. V. S.
Geoglossum luteum Pk.
Mitrula lutescens Berk.
Geoglossum pistillaris B. & Cke.
Corynetes luteus (Pk.) Hazsl.
Mitrula rufa (L. v. S.) Sacc.
Mitrula pistillaris (B. & Cke.)
Leptoglossum luteum (Pk.) Sacc.
Xanthoglossum luteum (Pk.)
Leptoglossum lutescens (B. & C.) Rehm var. mitruloids Rehm

Type: in herb. Phil. Acad. Nat. Sci., from New Jersey.

Plants solitary, gregarious or subcespitose, clavate, 2-5 cm. high, rather slender; ascigerous portion 1/3-1/2 the total length, elliptical-obovate, elliptical or subcylindrical, obtuse, usually compressed or longitudinally furrowed, 0.5-2 cm. long, 6-12 mm. wide, sharply differentiated from the stem, usually clear vitelline or orange yellow, rarley of a duller shade; stem terete, yellow, paler than the ascigerous portion, usually prominently squamulose, 1.5-3 cm. high, 2-3 mm. thick; whole plant becoming dingy yellowish- or reddish-brown when dry. Asci clavate, apex narrowed, pore blue with iodine, 100-140 x 10-12 u (majority 115-130); spores 8, biseriate, hyaline, smooth, cylindrical or slightly narrowed toward the obtuse ends, straight or curved, for a long time continuous, then multiguttulate, finally 5-10 septate, 18-38 x 5-6 u (25-35); paraphyses filiform, 2-3 u thick below, the apices slightly thickened and strongly curved or uncinate.

On rotten wood and humus rarely on mossy banks, frequent; July-September. Ontario to Louisiana west to Minnesota.

A very pretty and well marked species easily known by the yellow color of every part, the squamose stem, cylindrical septate spores, and the curved slightly thickened paraphyses. Various types were characterized by their authors as "rufous", or "luteus" or "rufescens" or "dull yellow" all of which may be true of the dried material from which all the species were described.t The fresh plant is much brighter. The scaliness of the stem always evident enough in the growing plant often becomes very obscure in drying or even disappears althgether.

2. Microglossum fumosum (Peck) Durand
Leptoglossum luteum var. fumosum Pk.
Leptoglossum fumosum Pk.
Type: in herb. N. Y. S. Mus. Nat. Hist., from New York.

Plants solitary or more often densely cespitose, clavate, 2-6 cm. high, robust; ascigerous portion obovate, elliptical or oblong, rounded above, more or less compressed and longitudinally furrowed, about 1/3-1/2 the total length of the plant, but little distinct from the stem,smoky-yellowish-clay-color or tawny, 0.75-3 cm. long, 3-12 mm. thick, rarely twisted or contorted, more or less puckered below where it joins the stem; stem terete or slightly compressed, 1-3 cm. long, 3-5 mm. thick, clay-colored, slightly squamulose or sometimes smooth and shining, with several longitudinal cavities, rather fibrous. Asci clavate, the apex narrowed, pore blue with iodine, 100-150 x 10-12 u; spores 8, biseriate, hyaline, smooth, cylindrical or slightly narrowed toward the obtuse ends, usually slightly curved, 20-50 x 5 u(35-43) , at first continuous, finally 7-15-septate; paraphyses filiform, septate, 2 u thick, slightly thickened and strongly curved above.

On much decayed rotten logs and about the bases of stumps; July-August. Massachusetts and New York.

This species is allied to M. rufum from which it differs in the clay-buff color, more robust chumked habit, smoother stem, and the longer spores with more septa. I have seen several instances in which the stem was forked, and young ascomata commonly arise from the base of the stems of older ones. In drying the stem becomes dark mummy-brown, shining, and the ascigerous portion brownish-ochraceous.

3. Microglossum longisporum Durand sp. mov.

Aseemata

Plants solitary, gregarious, clavate, often curved or contorted, righ cinnamon-brown, 3-6 cm. high: ascigerous portion occupying about 1/2-1/2the total length, slightly differentiated from the stem, oblong to elliptical, obtuse, more or less compressed and longitudinally furrowed, slightly darker than the stem, often with an umber tint, 1-2.5 cm. long, ±a 4-10 mm. wide, flesh yellowish brown; stem terete, squamulose, sometimes later becoming nearly smooth and hygrophanous, clammy or slightly visŧid below, 2-4 cm. long, 2-4 mm. thick, equal. Asci cylindrical-clavate, apex rounded, only slightly narrowed, the pore blue with iodine, 100-140 x 12-15 u; spores 8, of two kinds in the ascus: the first 2 in number(very rarely 3 or 4), lying side by side and nearly as long as the ascus, hyaline, smooth, cylindrical or a very little broader in the middle, ends rounded, straight or curved, at first continuous and multiguttulate finally becoming about 14-16-septate, 60-100 x 4-5 u; the second 6(rarely less) usually placed irregularly near the apex of the ascus, similar to the first kind but smaller, 12-18 x 3 u, rarely longer, usually continuous; paraphyses filiform, 2 u thick, hyaline, the apices slightly thickened and strongly curved or uncinate.

On the ground among leaves in the midst of grasses and carices, in rich woods and ravines; August. New York, North Carolina and Michigan.

A beautiful and distinct species characterized by the cinnamon-brown color, dimprphic spores, the large size of the larger spores, and the curved paraphyses.

4. Microglossum olivaceum (Pers.) Gill.

Geoglossum olivaceum Pers.
G. (Leptoglossum) olivaceum(Pers.) Cke.
Mitrula olivacea (Pers.) Sacc.
Microglossum contortum Rk.
Microglossum obscurum R k.

Type: European, no longer in existence.

Plants solitary or clustered, clavate, either regular or twisted or contorted, 2-8 cm. high; ascigerous portion occupying about 1/3-1/2 the total length, continuous with the stem but sharply delimited by color, greenish-brown often with a yellow or buff tint, compressed, obtuse, up to 3 cm. long, 10 mm. wide; stem terete or compressed above, perfectly smooth, shining, hygrophanous, yellowish-buff, tawny-buff, smoky-olive-buff or brownish-cervinus, fibrous, solid, 2-8 mm. thick. Asci cylindrical-clavate, apex rounded, rarely narrowed, pore blue with iodine, 75-100 x 9-10 u; spores8, biseriate above, uniseriate below, hyaline, smooth, oblong-fusiform to fusiform, straight, curved or sigmoid, for a long time continuous, finally becoming 3-septate, 12-18 x 4-6 u; paraphyses fili form, often branched, septate, straight or slightly curved or flexuous, not thickened above, hyaline.

On the ground among leaves or in grassy places in rich woods; May-September. North-eastern United States and Ontario.

A distinct species, quite variable in size and form, but well marked by the greenish buff or smoky tint of the fresh plant, the smooth fibrous stem, and the fusoid, ultimately 3-septate spores. The septa are often obscure but may usually be made more evident by iodine. Dried plants become more distinctly brown.

5. Microglossum viride(Pers.) Gill.
?Clavaria serpentina O.F. Mueller
?Clavaria mitrata viridis Holmsk.
?Clavaria viridis Schrad.
Geoglossum viride Pers.
Mitrula viridis (Pers.) Karst.
Helote viridis(Pers.) Hazsl.
Leptoglossum alabamense Underw.
Type: European, in herb. Persoon at Leiden.

Plants solitary, more often gregarious or cespitose, clavate, up to 5 cm. high; ascigerous portion about 1/2 the total length, sharply delimited from the stem, lanceolate to elliptical, obtuse, strongly compressed and deeply longitudinally furrowed in older specimens, 3-10 mm. wide, olive-buff or olive-ochraceous; stem terete, or slightly compressed, 2-5 mm. thick, conspicuously squamulose, pale pea-green; dried plants are darker sometimes almost black; crushed flesh pea-green to olive, usually pale. Asci clavate-cylindrical, apex rounded or slightly narrowed, pore blue with iodine, slender below, 110-150 x 8-10 u; spores 8, biseriate above, uniseriate below, hyaline, smooth, cylindrical-oblong, elliptical-oblong or oblong-clavate, ends obtuse, striaght or curved or sigmoid, for a long time continuous, finally becoming clearly 3-4 septate, 14-22 x 5-6 u; paraphyses filiform, branched, hyaline, the apices often slightly piriform-thickened and tinged green, forming a green epithecium.

On the ground, in moist woods, often along the borders of old wood roads; June-October. Eastern United States.

A fine species easily recognized at sight by the pea-green color and the squamose stem. It is not common, but is probably much more widely distributed than the localities mentioned would indicate. It is similar in color to Leotia chlorocephala by which it is often accompanied.

3. Corynetes Hazsl.
Geoglossum subg. Leptoglossum Cke.
Microglossum Sacc.
Leptoglossum (Cke.) Sacc.
Thuemenidium O. K.
Xanthoglossum (Sacc.) O. K.

Ascoma fleshy, erect, stipitate, clavate, the hymenium covering only the upper portion, black, brownish black or purplish black; Asci clavate-cylindrical, opening by a pore; spores 8, usually biseriate, hyaline, smooth, cylindrical, ends rounded, 3-many-septate; paraphyses present.

Plants with the habit and aspect of Geoglossum, but differing from that genus in the hyaline spores, and from Microglossum in the black color of the ascomata. The type species is C. microsporus (C.& P.) Hazsl.

8. Corynetes Hazsl.

A. Paraphyses hyaline or only slightly purplish tinted at the tips.
  B. Asci and paraphyses agglutinated at the tips into a conspicuous vinous-brown epithecium.
    C. Paraphyses clavate to piriform thickened at the tips.....1. C. purpurascens.
    C. Paraphyses not or only very slightly thickened at the tips.....2. C. atropurpureus.
  B. Epithecium lacking or inconspicuous; plants robust; paraphyses slightly clavate-thickened and more or less curved at the tips.3.C. robustus.
A. Paraphyses conspicuously brown... .....4.C. arenarius

1. Corynetes purpurascens(Pers.) Durand.
?Clavaria mitrata Holmsk.
Geoglossum purpurascens Pers.
Leotia atropurpurea Cordd
Geoglossum atropurpureum Cke.
Microglossum atropurpureum Sacc.
Thuemenidium atropurpureum O. K.
Mitrula purpurascens(Pers.) Mass.
Type: European, no longer in existence.

Plants solitary or cespitose, 3-6 cm. high, every part with a distinct purplish-brown tint when fresh, blackish when dry, the crushed flesh vinous-brown; ascigerous portion irregular, clavate, sometimes lobed or forked at the apex, ~~irregular~~ more or less compressed, 1-2 cm. long, up to 1 cm. broad, occupying about 1/3-1/2 the total length; stem cylindrical, minutely squamulose. Asci clavate, apex narrowed but rounded, pore blue with iodine, 105-120 x 10-12 u; spores 8, biseriate, hyaline, smooth, cylindrical, slightly narrowed from the middle to the rounded ends, striaght or curved, at first continuous, then multiguttulate finally 6-septate, 20-37 x 5-6 u (20-30); paraphyses filiform, hyaline, 3 u thick, the apices straight and abruptly obovate-piriform thickened, 8-10 u thick, agglutinated with amorphous matter to form a vinous-brown epithecium.

On the ground or humus; August-October. Maine and New York.

This species has usually been united with the following, but examination of authentic specimens of both shows that the present differs in the more distinctly purplish tint of the fresh plant, and especially in the more abruptly thickened tip of the paraphyses. The vinous-brown epithecium is conspicuous when a bit of the hymenium is crushed on a slide.

2. Corynetes atropurpureus (Pers.) Durand
Geoglossum atropurpureum Pers.
Mitrula glabra Karst.
Geoglossum microsporum C. & P.
Geoglossum microsporum var. tremellosum Cke.
Geoglossum tremellosum Cke.
Corynetes microsporus(C. & P.) Hazsl.
Leptoglossum microsporum (C. & P.) Sacc.
Microglossum atropurpureum Karst.
Xanthoglossum microsporum (C.&.P.) O.K.
Mitrula microspora (C. & P.) Mass.

Type: in herb. Persoon, at Leiden.

Plants solitary or cespitose, entirely black, at least when dry, rather slender, 2-3 cm. hgih; ascigerous portion about 1/2 the total length, narrowly clavate-oblong, obtuse; stem slender, minutely squamulose. Asci clavate, apex narrowed but rounded, 100-127 x 10 u; spores 8, biseriate, hyaline, smooth, cylindrical but tapering slightly toward the obtuse ends, at first continuous, finally becoming up to 10-septate, 25-35 x 3-4 u; paraphyses filiform, hyaline, branched, straight, the apices scarcely thickened and rarely only slightly bent, the tips of the asci and paraphyses being untied by a vinous-brown amorphous layer forming an epithecium.

On the ground in woods; September. New Hampshire and New York.

3. Corynetes robustus Durand sp. nov.

Plants solitary or gregarious often cespitose, black or brownish black, 2.5-8 cm. high, stout; ascigerous portion occupying about 1/4-1/2 the total length, not sharply differentiated from the spem, black with an olive-brown tint, piriform-elliptical, obtuse, 1-3 cm. long, 6-15 mm. broad, more or less compressedor longitudinally furrowed, sometimes twisted, hollow, flesh dark brown; stem terete or compressed, paler, shining brownish black, hygrophanous, lightly squamulose above, 1-4 cm. high, 3-8 mm. thick. Asci clavate, stout, sessile or short stipitate, apex narrowed, pore blue with iodine, 100-150 x 10-15 u(120-135); spores 8, biseriate above, uniseriate below, hyaline, smooth, cylindrical, slightly narrowed toward each end, at first continuous, multiguttulate, finally 7-11-septate, straight or curved, 25-50 x 4-6 u(30-40); paraphyses hyaline, filiform, branched, 2-3 u thick, the apex slightly irregularly thickened, usually curved or uncinate at the tips which are not or only slightly agglutinated into an epithecium.

On rich sandy humus among leaves in damp woods; August-September. Maine to Mississippi.

Closely related to the preceding but differs in the more robust, chumked, cespitose habit, larger spores, and absence of the conspicuous vinaceous-brown epithecium so noticeable in that species. The paraphyses are also more inclined to be thickened and more strongly curved above. I have seen spores 78 u long but these are unusual.

4. Corynetes arenarius (Rostrup) Durand
Microglossum arenarium Rostr.
Leptoglossum latum Pk.
Mitrula arenaria(Rostr.) Mass.

Type: in Copenhagen, from Greenland.

Plants single or cespitose, broadly clavate, black, 1-4 cm. hgih; ascigerous portion about 1/2 the total length, 0.5-2 cm. broad, irregularly bent or contorted, compressed, furrowed, blakk; stem brownish black or olive-black, pruinose or squamulose. Asci stout, clavate-cylindrical, apex narrowed, pore blue with iodine, 100-125 x 12-15 u; spores 8, biseriate above, uniseriate below, hyaline, smooth, cylindrical or cylindric-oblong, ends rounded, straight or curved, 25-~~35~~35x 6 u, for a long time continuous, finally becoming at least 4-septate(probably 10 or more); paraphyses brown, cylindrical, septate, longer than the asci, 3u thick below,the apices usually somewhat clavate-thickened and more or less curved.

In sand; September. Greenland, Labrador and Newfoundland.

A well marked northern species easily told from the other American members of the genus by the long, conspicuous, brown paraphyses. ~~Through the kindness of the late Dr. E.~~ Both Rostrup and Peck describe the spores as continuous , but some of them certainly become septate as described above

Corynetes globosus(Sommf.) Durand has not been collected since its original discovery in Lapland many ears ago. Two plants labled "Norge, Sommerfelt" are preserved in the herbarium of Elias Fries. Microscopical examination shows the species to belong in Corynetes, and to be very closely related to C. arenarius, differing principally in the paler color and subglobose head. The dried plants are blackish. The spores are nearly cylindrical, multiseptate, 25-30 x 5-6 u. The paraphyses are brown and longer than the asci. I suspect that when this species is rediscovered an examination of fresh material will show it to be the same as C. arenarius.

4. Gloeoglossum Durand nomen nov.

Geoglossum of authors in part.

Ascoma viscid-gelatinous, erect, stipitate, clavate, usually ascigerous only in the upper portion, black or brownish black; asci clavate-cylindrical,opening by a pore which becomes blue with iodine; spores 8, fascicled or multiseriate in the ascus, cylindrical or clavate-cylindrical, 3-15-septate (rarely continuous in one species), brown or fuliginous; paraphyses numerous, septate, thickened or coiled and brown above, not confined to the hymenium but continued down the stem to its base.

Plants with the general aspect of Corynetes and Geoglossum

But of a viscid-gelatinous consistency when fresh, and further characterized by the fact that the paraphyses are not confined to the hymenium but continue with unchanged form down the stem to its base, thus forming a thick gelatinous ectal layer or coating over it. The species of this genus preserve in the adult state a condition somewhat like that in very young ascomata of species of Geoglossum and Trichoglossum. In these the ascoma is at first completely covered with hairs which project outward at right angles to the surface. As it increases in size the asci are developed between these hairs in the upper or ascigerous portion where they then become the paraphyses. On the lower or stem portion the expanding tissue beneath soon causes them to become isolated or grouped in separate patches so that the surface appears squamulose. In Gloeoglossum, however, the mature ascoma is completely covered with a thick coating of densely crowded hairs, the form of the latter being characteristic of the species. This layer is especially conspicuous in cross section , which presents a strikingly different appearance from that of Geoglossum. A longitudinal section of the ascoma shows that the asci, abundant above, gradually cease as one passes downward, while the paraphyses/ continue in the same abundance, and with the same peculiar form as those in the hymenium. In Gl. difforme scattered asci may be found among them even to the base of the stem.

The typical species is Gl. difforme(Fr.) Durand

A. Spores 0-7-septate when mature.
  B. Spores 0-7-septate, clavate-cylindrical, 55-102 u long.....1. Gl. glutinosum.
  B. Spores 7-septate, clavate, 43-65 u long...2. Gl.affine.
A. Spores 15-septate when mature.....3. Gl. difforme.

1. Gloeoglossum glutinosum (Pers.) Durand
Geoglossum glutinosum Pers.
? Geoglossum viscosum Pers.
Geoglossum glutinosum β lubricum Pers.

Type: European, in herb. Persoon, at Leiden.

Plants solitary or clustered, 5-8 cm. height, viscid-gelatinous; ascigerous portion clavate or narrowly elliptical, more or less compressed, apex obtuse, 1.5-2.5 cm. long, 5-10 mm. thick, black, not sharply differentiated from the stem; stem 4-6 cm. long, 3-4 mm. thick, terete or slightly compressed, brown or brownish black, very smooth and viscid, covered to the base by the paraphyses; flesh brown, composed of parallel septate hyphae, rather looser in the center. Asci narrowly clavate, narrowed from the middle toward the apex, the pore blue with iodine, up to 250x 12-15 u; spores 8, multiseriate in the ascus, cylindrical, or slightly narrowed toward the rounded ends, fuliginous, at first continuous, then 3-septate, finally in most cases 7-septate, 55-102 x 5-6 u(75-85); paraphyses cylindrical, septate, 3u thick, longer than the asci, athe apices pale brown and abruptly piriform to globose thickened, 8-10 u thick.

On the ground and on rotten wood, in rich woods; July- September. Ontario to North Carolina.

A very neat species known by the terete, viscid, bronw stem and rather elliptical, darker ascigerous portion,

together with the 0-7-spptate, nearly cylindrical spores, and the long paraphyses with piriform to globose tips. ~~Through the kindness of Dr.~~

2. Gloeoglossum affine Durand sp. nov.

Plants solitary or gregarious, black, viscid-gelatinous when fresh, clavate, 1.5-2.5 cm. hgih; ascigerous portion narrowly clavate-oblong, obtuse, compressed, occupying about 1/2 the total length, up to 3 mm. thick, not sharply differentiated from the stem; stem slender, smooth. Asci clavate, apex rounded, 130-160 x 15 u; spores 8, fasciculate, smoky-brown, clavate, 7-septate, 43-65 x 5-6u; paraphyses slenderly cylindrical below, 2.5 u thick, slightly and gradually thickened above, the terminal portion septate, brownish, the terminal cell abruptly elliptical to globose thickened, 7-8 u diam,, the lower ones either cylindrical or nodulose, or abruptly and conspicuously thickened below the septa, in extreme cases almost globose, either straight or more or less curved or coiled above, and continuing down the stem to its base.

On soil or humus in swamps; August. New York.

Apparently a distinct species, a true Gloeoglossum in consistency and paraphysate stem. It is most nearly related to Gl glutinosum, but differs from it in the shorter, clavate spores always 7-septate, but more especially in the irregular swollen character of the cells of the paraphyses. In extreme cases these are moniliform, while in genuine Gl. glutinosum the paraphyses are strictly cylindrical, the terminal cell alone being swollen. The spores have the distinctly clavate form of those of Geoglossum glabrum or G. nigritum rather than the nearly cylindrical outline of those of Gl. glutinosum.

3. Gloeoglossum difforme(Fr.) Durand
Geoglossum difforme Fr.
Geoglossum Peckianum Cke.
Type: ? in herb. Elias Fries, from Sweden.

Plants solitary or gregarious, sometimes 2-3 together, black, smooth, viscid, especially below, evenly clavate, with no line of demarcation between ascigerous portion and stem, strongly compressed, apex obtuse, 3-6 cm. high, 8-14 mm. wide; flesh brown, composed of parallel, cylindrical, septate hyphae, rather looser in the center but not hollow. Asci clavate, gradually narrowed from the middle toward the apex, the latter rounded, the apical plug blue with iodine, 240-275 x 18-25 u; spores 8, in a parallel fascicle in the ascus, brownish fuliginous, clavate-cylindrical, slightly narrowed from the middle each way, ends rounded, straight or slightly curved, smooth, 15-septate at maturity, the cells about as long as wide, 95-125 x 6-7 u; paraphyses longer than the asci, slender, septate, tips slightly thickened, brownish, much coiled and twisted, continued down the stem to the base.

On soil, humus, decayed wood, or among pine needles in rich woods; July-September. Maine and Ontario to Florida and Michigan.

A splendid species known by the smooth, viscid, evenly clavate, much compressed ascomata, the 15-septate spores, and the paraphyses much coiled at the tips. It is the commonest of the dark-spored species in the vicinity of Ithaca, and will probably be found frequently throughout the eastern United States.

5. Geoglossum Pers.

Ascoma fleshy, erect, stipitate, clavate, hymenium covering only the upper portion, black or brownish black; asci clavate-cylindrical, opening by a pore; spores 8, fascicled or multiseriate in the ascus, cylindrical or clavate-cylindrical, 3-15-septate, fuliginous; paraphyses numerous, septate, usually brownish above, confined to the ascigerous portion.

The salient features of this genus are the clavate, black ascomata, not viscid but fleshy, the elongated, dark spores, and the fact that the paraphyses do not form a thick coating over the stem. While scattered or fasciculate hairssimilar to the paraphyses may be found on the stem in many species of this genus they never form the dense, conspicuous layer so characteristic of Gloeoglossum.

In collecting and studying specimens of the dark-spored Geoglossaceae great care should be taken not to get the species or spores mixed. I have frequently found quite dissimilar species growing together on the same substratum, so that only careful attention at the time of collecting will prevent mixing. In all the species the spores are projected at maturity so that they may be easily transferred from one plant to another either on the fingers or on wrapping paper. Whenever there seems to be a striking variation in spores one should notice only Those still within the mature ascus and thus avoid confusion. This is especially important when closely allied species are being studied. Extended study of many humdreds of specimens has shown me that the spores of the different species are far less variable in size and septation than some recent writings on the subject had led me to expect.

A. Paraphyses and asci free above, the apices not agglutinated to form a brown epithecium; spores early becoming brown.
  B. Spores 7, or 7-12-septate at maturity.
    C. Mature spores uniformly 7-septate; ascoma black or brownish black; paraphyses brown above.
      D. Paraphyses normally clavate in the distal third, closely septate, usually constricted or moniliform.....1. G. glabrum.
      D. Paraphyses remotely septate, scarcely moniliform, the thickening confined to the terminal cell.....2. G. nigritum.
    C. Mature spores 7-12-septate; ascoma tawny brown; paraphyses nearly hyaline...3. G. fallax.
  B. Mature spores 15-septate.....4. G. pygmaeum.

A. Paraphyses and asci agglutinated above forming a conspicuous brown epithecium; spores usually remaining for a long time hyaline.
   E. Spores 0-7-septate, paraphyses brown, the tips piriform..... .....5. G. cohaerens.
   E. Spores 7-12-septate, paraphyses nearly hyaline..... .....6. G. intermedium.
   E. Spores 15-septate, clavate-cylindrical...7. G. alveolatum.

1. Geoglossum glabrum Pers.
   ? Clavaria ophioglossoides L.
   Geoglossum sphagnophilum Ehrb.
   Geoglossum difforme Cke.
   Geoglossum simile Pk.
   Type: European, in herb. Persoon at Leiden.

Plants solitary or rarely clustered, gregarious, 3-7 mm. high; ascigerous portion black, about 1/3 the total lenght of the plant, lanceolate, compressed, 1-3 cm. long, 3-8 mm. thick, obtuse or acute, not sharply delimited from the stem; stem terete or slightly compressed, brownish black, rather slender, densely squamulose, 2-5 cm. high, 1.5-5 mm. thick, but commonly about 2 mm. Tissue composed of a fascicle of parallel, septate, brown hyphae, 10-12 u in dam., those in the center of the ascigerous part loose, those on the surface of the stem projecting to form flexuous, septate hairs up to 100 u long, single or agglutinated into groups. Asci rather stout, clavate-lanceolate, apex narrowed but rounded, pore blue with iodine, short stipitate, 170-200 x 20-22 u; spores 8, in parallel fascicle in the ascus, clavate, dark fuliginous, 7-septate, usually slightly curved, 60-105 x7-9 u(the majority 75-95); paraphyses slightly longer than the asci, typically clavate in the distal third, closely septated into cells rarely more than twice as long as broad, usually constricted at the septa and the cells often swollen so as to give a moniliform appearance, brown above, straight or curved, about 3 u thick below, 5-9 u thick above.

On very rotten wood, logs, stumps, or rich humus, rarely on soil; July-September. Newfoundland to Florida and California.

This cosmopolitan species is one of the commonest of the dark-spored forms, and will be found to occur throughout our range in suitable situations. The leading characters are the brownish black, compressed ascomata which are not viscid but clammy, the clavate, stout, 7-septate spores, and the closely septate commonly more or less moniliform paraphyses. The characters are quite variable as is to be expected in such a common, widely distributed species. In different specimens the terminal portions of the paraphyses show all gradations between chains of large bead-like cells and those which are nearly cylindrical but closely septate. It is often possible to find associated with these single ones which approach those of the next species.

2. Geoglossum nigritum Cooke

Type: in herb. Kew, from Sweden, E. P. Fries.

Plants usually solitary, clavate, black or brownish black, up to 8 cm. high; ascigerous portion lanceolate, compressed, rather acute, 1/2 the total length of the plant or less, 2-5 mm. thick; stem terete, slender, 1-2 mm. thick, furfuraceous, minutely squamulose or almost smooth; Asci clavate or clavate-lanceolate, apex anrrowed but rounded, 150-175 x 18 u; spores 8, in a parallel fascicle in the ascus clavate, fuliginous, 7-septate, 54-85x 6 u; paraphyses rather longer than the asci, cylindrical, septated into cells 2-10 times as long as wide, not constricted, rarely slightly swollen below the septa, pale brown above, either only slightly thickened, or the apex of the terminal cell piriform, usually more or less curved.

On wet ground, banks, or among leaves on rich humus, rarely on rotten wood; August-October. Maine to North Carolina and California.

Closely allied to G. glabrum but differs in the smoother stem, smaller asci and spores, and especially in the remotely septated paraphyses which are slender and thickened only in the terminal cell. It is the G. difforme of many writers but not of Cooke or Fries. When ascomata grow upon rich humus or rotten wood they are commonly large and robust, but on more sterile clay and gravelly banks they are much smaller and more slender, sometimes even minute. Such a condition seems to be G. glutinosum var. minus Sacc. I have a plant of this form from Saccardo, which is exactly matched by a specimen in the Ellis herbarium from Newfield, N.J. A few of the spores of the latter are 7-septate.

3. Geoglossum fallax Durand sp. nov.

? Geoglossum glabrum β paludosum Pers.

Plants solitary, clavate, 2-8.5 cm. high, entirely tawny-brown to umber-brown; ascigerous portion 1/5-1/2 the total length of the plant, lanceolate, obtuse, slightly compressed, about 8-15 mm. long, 3-5 mm. thick; stem short or elongated and slender, squamulose especially above, slightly thickened upward, 1-2 mm. thick below, 2 mm. thick above, terete. Asci clavate-cylindrical, the apex narrowed, pore blue with iddine, 150-175 x 18-20 u; spores 8, biseriate to multiseriate in the ascus, clavate-cylindrical, straight or curved, at first continuous and multiguttulate, then 3-, finally 7-12 septate, 65-105 x 5-7 u(80-100), for a long time hyaline, finally becoming fuliginous; paraphyses entirely hyaline, cylindrical, not closely septate, 5-6 u thick, usually strongly curved or circinate above, the apex abruptly elliptical to globose thickened.

On clay or loamy soil in woods or on slopes of ravines; July-October. New York and Michigan.

The characters are constant. The color is peculiar in being brown rather than black. The paraphyses are not colored, and are more conspicuously circinate above than those of other species of the genus. The spores resemble those of G. alveolatum in remaining for a long time hyaline, so that in some preparations only a few colored ones can be found. The majority of the spores have from 8-11 septa. The ectal hyphal layers of the stem become cracked above into squamules exposing the paler tissue beneath.

4. Geoglossum pygmaeum Gerard sp. nov.

Ascomata very small, 0.5-2 cm. hgih, brownish black when dry; ascigerous portion occupying about 1/2 the total length of the plant, narrow, compressed; stem terete, very slender, minutely hairy, Asci clavate, apex narrowed, 175-200x 17-18 u; spores 8, in a parallel fascicle in the ascus, brown or fuliginous, cylindrical-clavate, tapering slightly each way from above the middle, 15-septate, 122-140 x 6-7 u; paraphyses straight, about as long as the asci, cylindrical, 3 u thick, pale and sparingly septate below, the apex brown, septated into cells about 12-14 u long, slightly constricted at the septa, the terminal 2-3 cells clavate-thickened, the apical one usually more swollen and piriform to elliptical in outline, 10-14 x 7-8 u.

On ligneous earth, Poughkeepsie, N. Y. July. W. R. Gerard.

I should hesitate to describe it from such meagre material were it not one of the most distinct species of the genus. It should be found again in spite of its diminutive size. The spores are like those of Gl. difforme or T. hirsutum, but it is a true Geoglossum with no spines in the hymenium, and the paraphyses are very different from those of both of the species mentioned. The hairs on the stem are like those of G. glabrum, and not the cystidia of Trichoglossum.

5. Geoglossum cohaerens Durand sp. nov.

Plants clavate, 2.5-3.5 cm. high, black; ascigerous portion about 1/2 the total length, terete or compressed, obtuse; stem squamulose. Asci clavate, 150x12-15u; spores 8, multiseriate in the ascus, cylindrical-clavate, straight or curved, for a long time hyaline, later becoming pale brown, continuous to 7-septate, 40-55 x5u; paraphyses very numerous, rather longer than the asci, cylindrical, sparingly but irregularly septate, the tip rather abruptly clavate to piriform thickened, conspicuously brown above, the apices cohering with amorphous matter to form a brown epithecium above the asci.

On sandy soil in a door ya rd, Newfield, N.J., Nov. 6 and Dec. 1, 1899. J. B. Ellis.

The paraphyses are more conspicuously brown than in the other species of the genus, and strongly resemble those of Corynetes arenarius. The usual number of septa is 3-5, but rarely 6 or 7.

This species with the two following form a very distinct group of geoglossa, in which the tips of the asci and paraphyses are coalesced with amorphous matter to form a conspicuous brown epithecium , a condition similar to that found in Corynetes atropurpureus and C. purpurascens. In all three the spores remain for along time hyaline, and, in most cases, only a few ultimately become brown.

6. Geoglossum intermedium Durand sp. nov.

Plants solitary, black, 3-4.5 cm. high; ascigerous portion 1/2-1/3 the total length, oblong to obovate-lanceolate, compressed, obtuse or rounded above, usually abruptly narrowed to the stem below, 0.75-1.5 cm. long, 2-6 mm. broad, the hymenium prettily alveolate when dry, the meshes less than 0.5 mm. across;

stem slender, terete, usually more or less flexuous, brownish-black, 0.75-1 mm. thick, nearly smooth below, provided toward the top with slender, flexuous, sparingly septate, obtuse, brown hairs, up to 100 u long. Asci clavate-cylindrical, very short pediceled, apex narrowed but rounded, 150-200x20 u; pore deep blue and entire ascus slightly blue with iodine; spores 8, bi-multiseriate, stout, clavate but not much narrowed toward the lower end, ends rounded, somewhat curved, at first hyaline becoming 1-3-septate, finally rather pale brown, 7-11-septate, 55-75 x 6 u; paraphyses cylindrical, nearly or quite hyaline, straight or only slightly curved above, sparingly septate, very gradually and slightly thickened upward, the apex tending to become piriform to globose thickened, the apical portion of the asci and paraphyses agglutinated by an amorphous brown mass.

In swamp, Knoxboro, N.Y. Aug. 20, 1904. H.S. Jackson(D type).
Rotten wood, Guelph, Ontario, Aug. 19, 1905. J.H.Faull(D).
Intermediate between G. gallax and G. alveolatum. It resembles the latter externally, but differs in the shorter, much broader spores, which become 7-11-septate, and in the hyaline paraphyses. From G. fallax it differs in its black color and alveolate hymenium, besides the shorter spores and straight paraphyses. I saw 8 ascomata from Knoxboro and 7 from Guelph.

7. Geoglossum alveolatum Durand
Leptoglossum alveolatum(Durand in herb. meo) Rehm.

Plants solitary or gregarious, with the aspect of G. glabrum, slenderly clavate, 1.5-5 cm. high; ascigerous portion about 1/3 the total length, lanceolate, obtuse, compressed, black, 4-12 mm. long, 3-4 mm. thick, when moist with an even surface, which in drying often becomes pitted or distinctly ridged in an alveolate manner; stem slender, terete, 1-2 mm. thick, slightly thickened upwards, distinctly squamulose or hairy; flesh black, composed of a fascicle of parallel septate hyphae, 8-10u in diam., the ectal ones of the stem being produced to form slender, brown, flexuous, obtuse, septate hairs up to 125 u long. Asci clavate-cylindrical, apex slightly narrowed but rounded, pore blue with iodine, 150-170x 15u; spores 8, fascicled or multiseriate in the ascus, narrowly cylindrical, straight or curved, ends obtuse, one end sometimes narrower than the other, contents granular, at first continuous, then 7-, finally 15-septate, 60-95x 4-5 u; for a long time hyaline but ultimately becoming pale brown or fuliginous; paraphyses conspicuously brown above, cylindrical, septate, 3u thick, the tips abruptly elliptical to globose thickened, 6-8 u thick and agglutinated together into a brown epithecium.

On very rotten wood and logs, in ravines and moist woods; July-August. New York.

The characters are remarkable constant in the different gatherings, and determine it as one of the best marked species of the genus. It is a peculiar form which may easily be mistaken for a Corynetes. The spores remain so long uncolored that I was at first deceived into placing it among the species with hyaline spores. A careful search usually shows one or two asci with dark spores in each preparation. The spores show the further peculiarity of becoming fully septated while still hyaline. The alveolate character of the hymenium is not constant and seems phenomenon of drying. G. visculosum(Hazsl) Sacc. seems to be a related species.

6. Trichoglossum Boud.
Geoglossum Pers. in part.

Ascoma fleshy, erect, stipitate, clavate, hymenium covering only the upper portion, black; asci clavate, opening by a pore; spores 8, fascicled or multiseriate in the ascus, clavate-cylindrical, up to 15-septate, fuliginous or brown; paraphyses numerous, septate, brown above, confined to the ascigerous portion. Both the stem and hymenium beset with black, thick-walled, acicular spines or cystidia, which are usually longer than the asci.

The spines give the ascomata a velvety appearance quite characteristic. The generic type is T. hirsutum (Pers.). In my judgement Boudier was perfectly correct in separating this as a genus distinct from Geoglossum.

After making mounts from each of the large series of specimens at hand, I have studied the plants alone to see what consistent grouping could be made. External features, structure of sterile parts, cystidia, asci and paraphyses, all were examined and compared, but seem to offer few valuable separating characters. But when one notes the form, size and septation of the spores, the specimens readily fall into several groups which are distinct, and to my mind constitute well marked species. The characters mentioned are constant in the hundreds of ascomata examined from widely separated localities. A careful search has failed to reveal any intergrading forms, nor are the various types of spore in any way dependent on age, position in the plant, or conditions of environment, so far as one can judge. The student should be constantly on his guard against the accidental mixing of spores which may cause much confusion. Only those spores which are fully mature and still within the ascus should be depended upon for final judgment.

A. Spores normally 100-170 u long, narrowed each way from above the middle.
  B. Spores 4 in each ascus, 8-11-septate.....1. T. velutipes.
  B. Spores 8 in each ascus.
    c. Spores 15-septate.....2. T. hirsutum.
    C. Spores 7-14-septate.....T. hirsutum forms.
A. Spores normally 45-100 u long.
  D. Spores 0-5-septate, clavate-cylindrical...3. T. Farlowi.
  D. Spores 7-septate.
    E. Spores 55-73 u long, clavate.....4. T. Rehmianum.
    E. Spores 75-100 u long, clavate-cylindrical..5. T. Walteri.

1. Trichoglossum velutipes(Pk.) Durand.
Geoglossum hirsutum var. Americanum Cke.
Geoglossum Americanum (Cke.)
Geoglossum velutipes Pk.
Type: in herb. N.Y.S. Mus. From Northville, N. Y.

Plants solitary or gregarious, sometimes cespitose, up to 10 cm. high, black or brownish black; ascigerous portion lanceolate, elliptical or subrotund, 1/5-1/3 the total length of the plant, 3-15 mm. long, 4-10 mm. thick, more or less compressed, rounded above, usually rather sharply delimited from the stem;

stem terete, somewhat flexuous, 2-3mm thick, equal, black, velvety. Asci short stiptitate, clavate, apex narrowed, pore blue with iodine, 175-210 x 18u; spores 4, in a parallel fascicle in the ascus, smoky brown, narrowed each way from above the middle, 8-11-septate when mature, 115-166x6-7 u(mostly 130-150); paraphyses pale brown, cylindrical, sparingly septate, slightly thickened and curved or uncinate at the tips; spines variable in length, usually projecting 1/3-1/2 their length beyond the asci, sometimes shorter, acicular, black.

On soil, humus,or rotten wood, in late summer. Vermont to North Carolina and Minnesota.

A well marked species known by the tetrasporous asci and 8-11-septate spores. The latter are commonly broader and stouter than those of typical T. hirsutum. I do not find the length of the spines of diagnostic value. In two or three specimens examined, including the type of G. americanum, they project but little beyond the hymenium; but in all other gatherings including large numbers of ascomtat they are longer. There seems to be more variation in the individual plant than there is between groups. Both Cooke and Peck figure the asci with 4 spores, but the character is not mentioned in the descriptions. Gerard's original material is tetrasporous as is all the other seen.

2. Trichoglossum hirsutum (Pers.) Boud.

Geoglossum hirsutum Pers.

?Geoglossum capitatum Pers.

Type: in herb. Persoon, at Leiden.

Plants solitary or gregarious, black, 3-8 cm. high; ascigerous portion more or less elliptical or lanceolate in outline, hollow, obtuse, more or less compressed, up to 1.5 cm. long, 0.5-0.75 mm. thick, usually not more than 1/5 as long as the stem from which it is rather sharply delimited; stem terete, equal, up to 6 cm. long, 2-3 mm. thick, densely velvety, composed of a fascicle of parallel brown hyphae, 5-8 u thick, looser in the center, those at the surface projecting as short, septate hairs, giveing rise also to numerous acicular black spines up to 225 u long. Asci broadly clavate, apex narrowed, the pore blue with iodine, 210-225 x 20-22u; spores 8, in a parallel fascicle in the ascus, brown, cylindrical-clavate, broadest above the middle, tapering each way to the obtuse ends, 15-septate at maturity, 100-160x6-7 u(120-150); paraphyses brown, cylindrical, septate, usually strongly curved or coiled at the slightyly thickened tips, 3 u thick below, up to 8 u thick above; hymenial spines numerous, usually prpjecting about 1/3 their length beyond the hymenium, straight, acute, black, opaque, 8-10 u thick, variable in length.

On rotten wood or on humus among leaves,not uncommon; late summer. Ontario to Louisana and the West Indies west to California.

This species is readily known from the others of the genus by the long, regularly 15-septate spores, tapering each way from above the middle. The form of the ascigerous portion varies from almost rotund to lanceolate. In some individuals may be found all gradations from minimum to maximum length. G. capitatum Pers. is probably nothing more than a form of T. hirsutum; but in the absence of specimens there can be no certainty about it.

Several specimens of Trichoglossum have come to hand which are closely related to T. hirsutum but differ so from the typical form as to demand special mention.

Forma variabile Durand, f. nov.

Spores 8 in each ascus, variable in length, 80-150 u long, 8-14-septate, the majority 11-14-septate,. Otherwise as in the typical form.

The Knoxboro(N.Y.) collection is the most variable in septation and size of spores, but the majority have 11 or more septa. The spines project only slightly beyond the hymeniu. The Newark(Del.) and Blowing Rock(N.C.)specimens are more constant and agree closely in having spores 11-14-septate, 105-150 u long. The spines project about 1/3 their lenght, 15-septatespores are extremely rare in the three gatherings.

This form may not be different from the forma Bra brasiliense P. Henn.

Forma Wrightii Durand, f. nov.

Spores 8 in each ascus, 110-140 u long, stout, 8-9 septate. Otherwise as in the typical form.

I have seen two specimens of this form gathered in Cuba by Wright. Both are at Harvard. About four-fifths of the spores have 8 or 9 septa, while a few scattered ones have 5, 6, or 7. The spores are stouter than in the other forms of T. hirsutum. This form will, I think, prove to be a distinct species. The spores exactly duplicate those of T. velutipes, but there are 8 spores in the ascus instead of 4 as in that species.

3. Trichoglossum Farlowi (Cooke) Durand.
Geoglossum Farlowi Cke.
Geoglossum velutipes Pk.
Type: in herb. Kew, from Massachusetts, Farlow.

Plants solitary or clustered, 2-3 together, gregarious, 2-6 cm. high; ascigerous portion lanceolate in outline, not sharply distinguished from the stem, brownish-black, about 1/3 the total length of the plant, 1-3 cm. long, 3-5 mm. or more thick; stem terete, equal, often flexuous, rarely somewhat compressed, 2 mm. thick, 2-4 cm. long, black, densely velvety with acicular spines. Asci clavate, apex somewhat narrowed but rounded, pore blue with iodine, 170-200 x 15-18 u; spores 8, multiseriate in the ascus, clavate-cylindrical, tapering very little or not at all above the middle, fuliginous or brownish, 48-85 x 6 u(60-75), either continuous or 1-3-5-septate; paraphyses cylindrical, septate, curved to circinate at the somewhat thickened tips, brownish above; spines projecting about 1/3-1/2 their length beyond the hymenium.

On grassy

in open grassy woods, on humus among leaves or in moss; July-September Vermont to Florida and Mississippi.

This species superficially resembles the others of the genus but differs constantly in the shape, size and septation of the spores. Massee considers this to be a synonym of T. Walteri, but it differs constantly in the characters noted.

4. Trichoglossum Rehmianum (P. Henn.) Durand.
Geoglossum Rehmianum P. Henn.
Type: at Berlin, from St. Catharina, Brazil, col.

Plants solitary, when dry 1.5-2.5 cm. high; ascigerous portion 1/3-1/2 the total length, obovate, even or longitudinally furrowed, rather irregular; stem terete, 1-2 cm. high, 1-1.5 mm. thick, velvety with black spines. Asci narrowly clavate, apex rounded, 175x 12 u; spores 8, multiseriate, clavate-cylindrical straight or curved, fuliginous, at first 3-finally 7-septate, 55-73 x 4-5 u(60-68); paraphyses pale brown, slightly thickened above, straight or curved; spines projecting but little beyond the hymenium.

On Soil, Blowing Rock, N. Carolina, 1901. E. J Durand.

I have felt some little hesitation about referring this single collection to the Brazilian species of which I have seen no authentic specimens. The spores agree with those of T. Walteri in septation but are smaller and clavate rather than cylindrical. In size and shape they closely resemble those of T. Farlowi. I have however, carefully studied material of the latter species from nine states without seeing a single 7-septate spore. In the above described form the great majority of the spores are 7-septate, and those with fewer dividions are plainly immature. It is clearly different from the other trichglossa which I have seen, and I refer it to T. Rehmianum on the basis of the description only.

5. Trichoglossum Walteri(Berk.) Durand
Geoglossum Walteri Berk.
Type: in herb. Kew, from Australia.

Plants solitary or aggregated, 3-7 cm. or more high, brownish black; ascigerous portion narrowly elliptical to lanceolate, obtuse, not distinct from the stem, 1/3-1/2 the total length of the plant, 1-2 cm. long, 3-5 mm. or more wide, compressed; stem terete or compressed, about 2 mm. diam., densely velvety with black, acicular spines. Asci clavate, apex narrowed, obtuse, pore blue with iddine, 175-200 x 18-20 u; spores 8, multiseriate in the ascus, clavate-cylindrical., not narrowed above the middle, fuliginous or pale brown, 82-107 x 6 u(87-100); paraphyses cylindrical, septate, curved at the tips which are slightly thickende and brown. Spines acicular, projecting about 1/4-1/3 their length beyond the hymenium.

On rotten wood or humus; August-September. New Hampshire to Alabama west to Minnesota.

Resembling other species of the genus externally but well marked by the long, slender, nearly cylindrical spores which become regularly 7-septate at maturity. In the Australian type the plants were said to be "about 1 inch high". The American material is commonly much larger.

7. Spathularia Pers.

Ascoma fleshy, erect, stipitate, the ascigerous portion spathulate, much compressed, fan-shaped, decurrent on opposite sides of the stem from which it is sharply delimited; bright colored; asci clavate, opening by a pore; spores 8, fasciculate in the ascus, filiform-clavate, multiseptate; paraphyses present.

Spathularia differs from other genera of the family in having bright colored, spathulate or fan-shaped ascomata. The consistency and spore characters are those of Cudonia. The type species is S. flavida Pers. S. clavata (Schaeff.) Sacc.

I have been able to distinguish only two species in Amerida:
A. Stem pallid or yellowish pallid; mycelium pale yellow..1. S. clavata.
A. Stem bay-brown, minutely velvety; mycelium orange..2. S. velutipes

1. Spathularia clavata(Schaeff.) Sacc.
Elvella clavata Schaeff.
Spathularia flavida Pers.
Spathularia flava Pers.
Spathularia flavida var. rugosa PK.
Spathularia rugosa Pk.
Mitruliopsis flavida Pk.
Type: European, probably no longer in existence.

Plants solitary or usually gregarious, rarely cespitose 2-3 together, sometimes growing in lines or circles, fleshy, up to 10 cm. high, whole plant pallid when young and fresh, then becoming yellowish or brownish; ascigerous portion darker than the stem, much compressed, fan-shaped, obtuse or rounded, decurrent on opposite sides of the stem, even or undulate or radiately rugose, sometimes contorted, or clavate or almost capitate, occupying about 1/2-1/2 the total length of the plant, up to 2 1/2 cm. wide; stem hollow, smooth or farinose, terete or somewhat compressed, tapering slightly upward, often swollen or bulbous below, slightly brownish at the base, up to 1 cm. diam.; attached by a pallid or yellowish mycelium; flesh white; plants usually becoming yellowish brown when dry. Asci clavate, apex conspicuously narrowed often submammiform, not blue with iodine, 100-125 x 12-14 u; spores 8, in a parallel fascicle in the ascus, often twisted together above, smooth, clavate-filiform, mulitseptate, hyaline, 35-65x2.5-3 u(40-50; paraphyses filiform, branched, hyaline, much curled or coiled at the apices, not thickened.

On soil or humus, but most commonly under pines among the needles; July-October. New Brunswick to California, rare or absent in the south.

A common species very variable in form and surface features, but distinguished by the pale color of the whole plant and the pale yellow mycelium. I can find no character or combination of characters to separate S. rugosa Pk. from this species. That species was said to have the clubs(ascigerous portions rugose, the stem more velvety, the spores shorter , and to grow in circles. Nearly all descriptions of European specimens mention the great variability of the surface character.

I have seen the type of Mitruliopsis flavida Rk. and am compelled to regard it as a depauperate form of S. clavata. The structureal characters, consistency, etc. are identical in every respect. The paraphyses instead of being absent as stated are abundant and typical; the spores measure 55-65 u long, and the ascigerous portion, though narrow, is decurrent on opposite sides of the stem.

2. Spathularia velutipes Cke. & Farlow

Type: in herb. Kew, from New Hampshire, W. G. Farlow.

Plants solitary, or usually gregarious, occasionally cespitose several being united by a common base, up to 5 cm. high, 1-3 mm. wide, fanshaped; ascigerous portion much compressed, yellowish to brownish-yellow, decurrent on opposite sides of the stem, the margin rounded, even or often wavy or incised or lobed, sometimes contorted, about 1 cm. high at the top; stem varying from nearly terete or compressed to broadly expanded and flattened above, rather rounded in outline at its junction with the ascigerous part, 2-4 cm. high, up to 1.5 cm. broad above, 3-5 mm. thick at the base, solid, bay-brown and minutely velvety, attached by an orange mycelium; the plant shrinks but little in drying, the color becomes brownish and the stem more or less longitudinally rugose or striate. Asci clavate, apex narrowed, not blue with iodine, 80-105 x 10 u; spores 8, in a parallel fascicle in the ascus, hyaline, smooth, clavate-filiform, straight or curved, becoming multiseptate, 33-43x2u (35-40 u); paraphyses filiform, hyaline, branched, strongly curved or coiled at the tips.

On rotten logs, humus among leaves, or especially on the ground under pines; August-September. New Hampshire to North Carolina and Minnesota.

A common species easily known by the bay-bronw, minutely velvety stem, and the bright orange mycelium from which the plants arise. Cooke, Massee and others give the measurements of the spores as 55-60 u long, but I have not succeeded in finding one more than 43 u long and the majority are less than this. The species is not uncommon in the vicinity of Ithaca, in the humus on the banks of glens. In the North Carolina mountains I found it very abundant under pines. S. velutipes is evidently closely allied to S. rufa Swartz(not Nees), but is distinguished by the much smaller asci and spores.

8. Leotia Pers.

Hygromitra Nees

Ascoma more or less gelatinous, stipitate, erect; ascigerous portion pileate, horizontal, supported in the center, bearing the hymenium spread over its upper convex surface, sterile beneath; asci clavate, opening by a pore; spores hyaline, oblong-fusiform, at first continuous, finally 3-5-septate; paraphyses present.

The type species is L. lubrica (Scop.) Pers.

Species of Leotia can be studied satisfactorily only in the fresh, living condition. Some species change but little in alcohol or formalin, but others, especially L. lubrica, have their colors so modified as to be misleading. Preserved material of all species to be of value must be accompanied by carefully made notes on the form and colors. of the living plants.

Mr. Geo. Massee in his minographof the Geoglosseae Treats L. stipitata, L. chlorocephala and L. Stevensoni as forms of L. lubrica which "are in reality nothing more than phases of development of the present species in passing from north to south. The small, clustered form--Stevensoni Berk. --is the more northern condition..... Then follows the typical form; further south we get chlorodephala Sz., and finally passing into the warm subtropical region, we have stipitata(Bose) ...., the largest and darkest colored condition of the species .....In the United States the dark green forms being not uncommon, whereas there are but few records of the typical form."

My own field observations both in the north and south have led me to the conclusion that the "forms" mentioned have no relation whatever to latitude. While I too regard L. Stevensoni as a form of L. lubrica in the case of the others mentioned the the condition is different. L. stipitata is as common in New York as in North Carolina. Its coloration is perfectly constant in all localities and habitats and in all stages of development. It is just as constantly different from all forms of L. lubrica, which is ordinarily yellowishochraceous with a greenish tint, or less commonly olivaceous. The hymenium of L. lubrica sometimes assumes a deeper green in the last stages of decay, but it never approaches the deep clear aeruginous green of L. stipitata. Both species are commonly viscid-gelatinous and translucent, but in rather dry situations the consistency is firmer. L. chlorocephala, on the other hand, is a plant of dryer firmer consistency even when growing in very wet situations.

The stem of Leotia consists of three well defined layers. In the center is a core of very loosely interwoven, branched, slender hyphae. At the summit of the stem this tussue expands to form the whole sterile part of the head. On the surface is a similar cortical layer of varying thickness. Between the two is denser mesal layer forming a cylinder the whole length of the stem, the component hyphae of which are stouter and septate, and cohere so closely as to resemble a pseudoparenchyma. At the summit of the stem this tissue fades out so that the core and cortical layer become continuous just before the beginning of the hymenium. The core sometimes becomes hollow, and it and the cortex are much more gelatinous than the mesal cylinder.

The following arrangement and descriptions of species are based primarily on a comparative study of the living growing plants.

A. Plants entirely yellowishochraceous, sometimes olivaceous.....1. L. lubrica.

A. Hymenium aeruginousgreen, stem white to yellowish.....2. L. stipitata.

A. Plants entirely green, stem furfuraceous, substance firm, plants slender.....3. L. chlorocephala.

1. Leotia lubrica (Scop.) Pers.
Elvella lubrica Scop.
Helvella gelatinosa
Type: European, probably no longer in existence.

Plants usually densely cespitose, stipitate, more or less viscid-gelatinous, ochraceous-yellow, often with a greenish or olive tint, 3-6 cm. or more high; ascigerous portion pileate, convex above, the surface often irregularly furrowed, with a recurved margin, wrinkled or nodulose, 1-1.5 cm. or more broad; stem terete or somewhat compressed , usually tapering slightly upward, the adjacent ones often coalescing below, about 1 cm. thick below, 0.5 cm. above, up to 5 cm. or more high, minutely squamulose, sometimes with innate greenish granules. Asci narrowly clavate, apices rounded, slightly narrowed, not blue with iodine, 130-160 x 10-12 u; spores 8, biseriate above, uniseriate below, hyaline, smooth, cylindric-oblong to fusiform, ends obtuse or subacute, straight or curved, 18-28x 5-6u(20-23 u), at first continuous, then 3-8-guttulate, finally becoming 5-7-septate; paraphyses filiform, branched, the apices clavate to piriform, hyaline, the tips agglutinated by amorphous matter.

On rich humus or sandy soil rarely on rotten wood, in woods; July-September. Ontario to Alabama and Iowa.

Leotia lubrica is perhaps the commonest me mber of the Geoglossaceae in the eastern United States, frequently occurring in considerable abundance. The great variability of this species has long been a matter of comment, and many of the forms early received names. No other species of the family is so sensitive to the varying conditions of its environment. The form, consistency, and even the color depend much upon the character of the substratum as well as upon the situation of the plant and the consequent amount of moisture supplied to it In very wet situations or during rainy weather the plants are swollen and soft watery gelatinous or tremellose, but in drier times or in drier situations they are firmer and often cartilaginous,. In all cases they shrink much in drying.

Several different forms of Leotia have been reported from America which field studies have convinced me are environmental states of L. lubrica. Since, however, certain of these in extreme cases look quite different from the normal condition it seems desirable to distinguish them as forms.

Leotia lubrica forma Stevensoni(B.& Br.)
Leotia Stevensoni B.& Br.

Plants mostly clustered, of firm consistency, entirely greenish or olivaceous, the stem slightly paler than the hymenium, usually more or less furfuraceous.

On sandy or gravelly soil, coextensive with the typical form.

While the normal color of well developed plants of L. lubrica is ochraceous in tone one frequently meets with specimens, especially on sandy or gravelly soil containing but little humus, which are firmer in consistency, have a marked greenish or olivaceous cast on both hymenium and stem, and have the latter more or less furfuraceous. These correspond to L. Stevensoni B. & Br.,

as nearly as one can judge from the brief original description and from dried type at Kew. In several different localities where material was abundant I have been able to trace every possible gradation between this and the typical form in passing from rich leaf humus to adjacent sandy or gravelly knolls.

Leotia lubrica forma Lloydii(Rehm)
Leotia chlorocephala var. Lloydii Rehm.
Leotia punctipes Peck.

Plants usually solitary, slender, entirely olive-ochraceous, rather firm. Stem furfuraceous especially above. On drying the hymenium becomes much darker green or olive, the stem olive-yellow,and more conspicuously beset with green points.

Massachusetts to Michigan; August-September. Probably widely distributed.

Although the Massachusetts collection was reported as growing "among sphagnum" in my experience the form is more often to be found on rich humus or on rotten wood on the banks of ravines in rather dry situations. A Leotia collected at Sorrento Springs, Fla., by Dr. Thaxter probably belongs here.

When the typical ochraceous form of L. lubrica grows on the drier banks of our ravines its consistency is firmer, sometimes almost cartilaginous, and the habit is consequently more slender than usual. This in my opinion is Leotia marcida ("Fl. Dan.") Pers. All the specimens which I have seen called L. marcida are indistinguishable internaly from L. lubrica.

2. Leotia stipitata (Bosc) Schroeter,
Tremella(Hygromitra) stipitata Bosc.
Hygromitra stipitata Nees
Leotia viscosa Fr.
Type: from South Carolina, perhaps in Bosc's collection at Padua.

Plants solitary or clustered, stipitate, viscid-gelatinous, 3-6 cm. or more high; ascigerous portion 1-2 cm. or more broad, margin incurved toward the stem, even or irregularly nodulose, hymenium clear deep aeruginous green, whitish below; stem terete or tapering slightly upward, usuallypure white or less often with an ochraceous or orange tint, 2-4 cm. high, 0.5-1 cm. thick, often beset, especially above, with minute green squamules. Asci narrowly clavate-cylindrical, not or only slightly narrowed, not blue with iodine, 118-150 x 10 u(130-140); spores 8, biseriate above, uniseriate below, hyaline, smooth, at first continuous, finally 5 or more septate, ends obtuse or subacute, straight or curved, 16-28 x 5-6 u(20-24); paraphyses filiform, branched, the apices piriform, intense green when fresh.

In rich humus or soil especially among leaves in woods or on the slopes of ravines; August-September. Maine to Florida and California.

The most beautiful and most clearly marked species of the genus, with the habit of robust specimens of L. lubrica, but the stem usually paler, and the hymenium intense aeruginous green. This species is not uncommon about Ithaca and is abundant in the North Carolina mountains, so that I have had good opportunity to study it in all conditions of growth. The colors of the fresh plant are constant under all conditions of moisture, and during all stages of development. The green squamules are most abundant near the upper end of the stem, and are usually so minute and scattered as to be visible only with a lens. They never give more than the faintest tint of green to the surface. I have seen no intergrading forms between this and other species. The contrast in color between the hymenium and stem is very marked and the plants appear extremely prettily nestled among the leaves. The hymenium imparts a deep green stain to paper which it touches.

3. Leotia chlorocephala L. v. S.

Type: in herb. Phil. Acad. Nat. Sci. from Salem, N. Carolina.

Plants solitary to densely clustered, subgelatinous, entirely green, 1-5 cm. high; ascigerous portion hemispherical, convex, margin incurved, obtuse, hymenium smooth or furrowed, the margin often lobed or nodulose, pea-green to aeruginous, 2-10 mm. wide; stem terete, firm, the middle layer green, surface densely squamose or furfuraaeous with green granules, 1-4.5 cm. high, 2-4 mm. thick, shrinking much in drying but the color changing but little. Asci narrowly clavate, apex rounded, not blue with iodine, 125-150 x 10-12u, short stipitate; spores 8, subbiseriate above uniseriate below, hyaline or with a faint greenish tint, narrowly elliptical to elliptical-fusiform, ends obtuse or subacute, at first continuous finally about 5-septate, straight or curved, 18-20x5-6 u; paraphyses filiform, branched, the apices fpiriform, green.

On sandy soil in rich woods, on knolls, or along wood roads or among mosses in ravines; August-September,. New Hampshire to Alabama.

This species may be known by the firm clammy substance which is opaque, not so translucent as in L. lubrica, the green color of every part, and the furfuraceous stem. The color of the fresh plant corresponds very closely to that of Microglossum viride with which it is often associated. One might well conceive of it as an M. viride with the form of a Leotia. One mycologist wrote me about a green "Geoglossum which becomes a Leotia in the mountains". The species is not uncommon in the mountains of North Carolina but seems to be rarer northward. The finest growth I have ever seen was among Atrichum, on sandy soil within a few inches of running water., In a ravine near Blowing Rock, North Carolina. Although the moss was very wet the ascomata retained their firm clammy consistency so different from that of L. lubrica in drier situationssin the same glen.

The name"chlorocephala" itself implies that the head only is green.

9. Vibrissea Fries

Ascoma Stipitate, pileate, soft, waxy or subgelatinous; ascigerous portion hemispherical, bearing the hymenium on its upper convex surface, sterile below; asci long cylindrical, narrow, opening by a pore; spores 8, in a parallel fascicle and nearly as long as the ascus, hyaline, filiform, many-septate; paraphyses slender.

Some writers have united Cudonia with Vibrissea, but they seem to me to represent two well marked generic types. It is much preferable to limit the present genus to fungi with aquatic or semiaquatic habit, soft-waxy or subgelatinous consistency, very narrow cylindrical asci, and extremely slender, filiform, hair-like spores, which are nearly as long as the ascus

The following quotation from Phillips gives an excellent idea of the habit of the genus: "All of the above species of Vibrissea grow on decayed wood which has been for some time immersed in water. Unlike the majority of fungi, nearly the whole of, if not all these plants require partial or complete immersion in water for their complete development, for which reason they should be regarded as aquatic fungi. I have gathered some hundreds of specimens of Vibrissea truncorum in North Wales, nearly all of which flourished nnder water; and in the few cases where they occurred above the surface of the water the branches of wood on which they grew were entirely submerged.

The stem of Vibrissea consists of a bundle of rather stout, parallel, septate hyphae, the cortical ones being constricted at the septa so that a tissue resembling pseudoparenchyma is produced. The superficial hyphae project as rather long, brown, septate hairs. As the stem expands into the head the cortical layer gives place to a pseudoparenchyma, which forms the inferior sterile surface, the subhymenial portion being hyphal.

Two species of the genus occur in North America.

A. Spores 175-250 u long.....1. V. truncorum.
A. Spores 85-100 u long.....2. V. foliorum.

1. Vibrissea truncorum (A.& S.) Fries,
Leotia truncorum A.& S.
Leotia clavus Pers.
Vibrissea truncorum var. albipes Pk.
Type: European

Plants solitary, gregarious or in clusters of 2-3, 4-15 mm. high; ascigerous portion hemispherical-convex, margin obtuse, 3-5 mm. diam., yellow, orange or reddishorange, rarely pallid; stem terete, up to 1.5 cm. high, 1-2 mm. thick, white to bluishgray or brownish, minutely squamulose, due to minute spreading hypha, rather darker below. Asci slenderly cylindrical, apex rounded, not blue with iodine, 200-325 x 5-6 u; spores 8, in a parallel fascicle in the ascus, hyaline, very slenderly filiform, slightly narrowed toward each end, nearly as long as the ascus, multiseptate, up to 250x1 u; paraphyses filiform, occasionally forked, the apices somewhat clavate-thickened and colored.

On wholly or partly submerged sticks etc., in brooks, mostly in higher altitudes; June-August. Labrador to West Virginia, Cascade Mts. and Alaska.

This species is most common in cold mountain brooks, and seems to be abundant where it occurs. Dr. Farlow writes thus of its distribution in the White Mts.: " This species which is seldom found in the lowlands of New England is a common and characteristic species in cold brooks, and is especially abundant along the torrants which fall into King's and Tuckerman's Ravines". I have looked for it in vain in the vicinity of Ithaca, N.Y. and in the mountains of North Carolina. Specimens reach their best development under water, where the long spores project from the asci giving the hymenium a silky appearance, and by their vibration give the name to the genus.

2. Vibrissea foliorum Thaxter sp. nov.

Plants solitary or gregarious, stipitate, of soft consistency; ascigerous portion convex, 1-1.5 mm. diam., yellowish orange; stem pallid, 2-3 times as long as the diameter of the head, slender, translucent, slightly furfuraceous with projecting hairs below. Asci narrowly cylindrical, apex rounded, not blue with iddine, 150-180 x 5-6 u; spores 8, in a parallel fascicle in the ascus, hyaline, slenderly filiform, 85-100xlu; paraphyses filiform, hyaline, not exceeding the asci, simple or occasionally forked near the distal ends, very slightly piriform-thickened at the tips.

On dead oak leaves, acorn cups, etc. in a wetplace. West Haven, Conn.,R. Thaxter. Type in herb. Harvard University.

Very similar to V. truncorum in color and habit, but differs in the semiaquatic habitat, and more especially in the smaller asci and spores.

10. Apostemidium Karst.
Gorgoniceps Karst.
Vibrissea Phill.

Ascoma sessile, turbinate or convex, soft waxy or subgelatinous, hymenium spread on the upper convex or plain surface, sterile below. Asci narrowly cylindrical, opening by a pore; spores8, in a parallel fascicle in the ascus, hyaline, filiform, many-septate, nearly as long as the ascus; paraphyses present.

Aquatic or semiaquatic fungi with the habitat and fructification fo Vibrissea but sessile. A condition exactly comparable to this would be produced by removing the stem from a plant like Vibrissea truncorum so that the ascigerous portion would be sessile on the substratum. Some specimens are narrowed below, but there is never more than a suggestion of a stem-like base.

The genus Apostemidium is intermediate between the Geoglossaceae and Mollisiaceae, but its structure is so similar to that of Vibrissea that it seems best to place it near that genus.

The sterile part of the ascoma of Apostemidium consists of two portioms. A thin subhymenial layer is composed of hyaline interwoven hyphae. Outside of this is a pseudoparenchyma composed of thin-walled, more or less radiating, polygonal cells forming the base, cortex and margin of the cup The inner cellls have hyaline walls while the ectal ones are brown. The latter often project slightly causing the surface to appear furfuraceous. This structure is exactly like that of Vibrissea truncorum.

In some material specimens otherwise resembling ascigerous ascomata have the "hymenium" consisting of a dense mass of slender, parallel hyphae, with side branches at intervals, each bearing at its apex a minute elliptical conidium about 3xl u. Such specimens in general structure resemble the sporodochia of some Tuberculariaceous fungus. While I have seen no asci or paraphyses intermixed with such conidiophores, nor conidiophores in normal ascigerous ascomata, it seems probable that the one form is an imperfect or conidial condition of the other. The two conditions occur intermingled on the same stick. The ascigerous cups are rather larger and more expanded than the others and have a deeper color, otherwise there is little gross difference.

All the American material which I have seem falls into two groups as follows:

A. Paraphyses longer than the asci, repeatedly forked near the apices, the tips abruptly piriform,hyaline....1.A. Guernisaci.
A. Paraphyses equaling the asci, simple or rarely forked, the ends clavate-thickened,colored.....2.A. vibrisseoides.

1. Apostemidium Guernisaci (Cr.) Boud.
Vibrissea Guernisaci Cr.
Gorgoniceps Guernisaci(Cr.) Sacc.
Gorgoniceps turbinulata Rehm
Type: from near Brest, France.

Ascomata solitary or gregarious, sessile by a rather broad base, turbinate or convex; hymenium plain to convex, bluish-pallid to orange-ochraceous, 1-4 mm. diam., even or sometimes wrinkled, often with a dimple in the center, dark brownish below, somewhat furfuraceous. Asci long, cylindrical, apex rounded, not blue with iodine, 225-300x5-6u; spores 8, in a parallel fascicle in the ascus, hyaline, slenderly filiform, multiseptate, 200-250xlu; paraphyses numerous, filiform, hyaline, longer than the asci) the apical portion(about as much as projects beyond the asdi) repeatedly forked or fasciculately branched, the tips abruptly piriform-thickened, hyaline, 4-5u thick.

On dead sticks and wood in water: May-August. New England States and Washington.

Distinguished from the next species by the hyaline, peculiarly branched paraphyses, which are longer than theasci.

The color of the hymenium seems to be quite variable in this species. Crouan freres, Patouillard and Phillips describe it variously as being white, greenish-yellow, ochraceous-yellow, gray or bluish-gray. I do no think subdivisions of the species can be made based on color. In August, 1904, I saw a magnificent growth of this species near Halifax, Yorkshire, England. The plants were growing on dead thorn branches in a waterfall where they were constantly saturated by the spray. The hymenium was a clear ochraceous to orange-yellow.

2. Apostemidium vibrisseoides(Pk.) Boud.
Helotium vibrisseoides Pk.
?Vibrissea turbinata Phil.
?Gorgoniceps turbinata(Phil.)
Gorgoniceps vibrisseoides (Pk.)
Type: in herb. N.Y. State Mus. Nat. Hist., from New York.

Plants gregarious, sessile, turbinate, 2-3 mm. diam.; hymenium plain to convex, varying in color from bluish pallid to yellowish or ochraceous, base of the cup brownish. Asci long cylindrical, narrow, apex rounded, not blue with iodine, 275-300x5-6u; spores 8, in a parallel fascicle in the ascus, long filiform, hyaline, multiseptate, up to 250x1u; paraphyses not numerous, slender, 1-1.5 u thick below, simple or occasionally forked, the apical portion clavate-thickened, colored, up to 6 u thick, about as long as the asci.

Decaying sticks lying in the water; May-July. New Hampshire to New York.

In August, 1904, in company with Mr. Chas. Grossland, I collected several specimens near Halifax, England, which belong to this species. They were growing on dead sticks, etc., in a small rivulet, and showed all gradations in color from horn-color to ochraceous.

11. Cudonia Fries

Ascoma stipitate, erect, fleshy-leathery; ascigerous portion pileate, hymenium on the upper convex surface, sterile beneath, margin acute, incurved toward the stem; asci clavate, opening by a pore; spores 8, hyaline, clavate-filiform, multiseriate or fasciculate in the upper part of the ascus, multiseptate; paraphyses present.

A genus closely related to Vibrissea with which it is united by some writers. It seems to be sufficiently distinct in the terrestrial habit, more leathery consistency, acute margin, short, clavate asci, with the spores clavate-filiform and a little more than one half the length of the ascus.

The veil alreadydescribed as covering the young hymenium has been observed only in C. lutea, but will doubtless be found to be a feature of other species.

Three species occur in North America.

A. Spores 30-45 u long; plants pale brownish to buff, often with a rosy tint..... .....1. C. circinans.
A. Spores 45-78 u long; plants entirely yellowish.....2. C. lutea.
A. Spores 18-25 u long; cap ochraceous stem white.....3. C. ochroleuca.

1. Cudonia circinans(Pers.) Fr.
Leotia circinans Pers.
Vibrissea circinans(Pers.) Hazsl.
Type: European, in herb. Persoon, at Leiden.

Plants solitary or gregarious, fleshy, becoming more distinctly leathery in drying, 2-6 cm. high; ascigerous portion 0.5-2 cm. broad, rather thin, margin acute and recurved, even or undulate, hymenium convex, even or wrinkled or convoluted, cream-buff with a faint rosy tint, or sometimes yellowish or pale brownish; stem tappering slightly upward, often stout below where it is 2-10 mm. thick, 1.5-5 mm thick above, darker than the hymenium especially belwo, often longitudinally striate especially above, the striae being prolonged as radiating veins on the lower side of the cap, somewhat farinaceous, sometimes becoming hollow in age. Asci clavate, apex narrowed, not blue with iodine, 85-130 x 8-10 u (100-115u);

spores 8, fasciculate, hyaline, smooth, clavate-filiform, broadest above the middle or at the distal end, 30-45x2 u (34-40ü); paraphyses hyaline, filiform, strongly curved above, often branched, tips only slightly thickened, 2u thick.

On rotten wood or humus among leaves; often under coniferous trees; July-September. Newfoundland to Colorado and Alberta, principally northward.

This species is much less common in the east than C. lutea, from which it differs in color and shorter spores.

2. Cudonia lutea (Pk.) Sacc.

Vibrissea lutea Pk.

Leotia lutea (Pk.) Cke.

Type: in herb. N.Y. State Mus. Nat. Hist., from North Elba, N. Y.

Plants solitary or gregarious, rarely clustered, 1-6 cm. high, but usually about 3 mm., flehsy-leathery; ascigerous portion pileate, convex, the margin acute, reflexed, hymenium when young covered by a volva-like membrane which later cracks irregularly and falls away leaving remnants attached to the margin, usually slightly depressed above, sometimes furrowed, beautiful flesh-color to orange-buff, the under surface often with radiating striae which continue down the stem, 5-15 mm. diam.; stem terete or slightly compressed, sometimes inflated below, even or longitudinally striate, mealy, pale yellow, 1-5 cm. hgih, 2-5 mm. thick. When dry the whole plant becomes about the color of chamois skin or of Otidea leporina. Asci clavate, apex narrowed, not blue with iodine, variable in size, 100-170x10-12u; spores 8, ina fascicle in the upper part of the ascus, hyaline, smooth, with a hyaline gelatinous sheath, clavate-filiform, lower end acute, not narrowed above the middle, 45-78 x 2 u(55-65 u); paraphyese filiform, branched, not thickened but strongly circinate at the tips.

On decaying leaves in thickets, rarely on rotten wood, chestnut burrs, etc.; August-September. Ontario to Tennessee, eastward.

This species is distinct from the preceding in the yellow color of every part, and in the longer spores. The finest develppments of Cudonia lutea are to be found on rather dry dead beech leaves in beech thickets, where the plants often spread over considerable areas.

3. Cudonia ochroleuca (C.& H.) Durand

Leotia ochroleuca Cke. & Hark.

Vibrissea ochroleuca(C. & H.)

Type: in herb. Kew, from San Rafael, California.

Plants scattered, stipitate, pileate; ascigerous portion convex, "ochroleucus", 6 mm. diam. when dry;"stem slender, flexuous, white,"longitudinally striate or rugulose, 8-10 mm. high; whole plant when dry dark reddish brown, substance apparently not subgelatinous. Asci clavate, slenderly stipitate, apex narrowed, not blue with iodine, 75-100x 8-9u; spores 8, multiseriate in the ascus, clavate-filiform, acute at each end, hyaline, 3-more-septate, 18-25x2u; paraphyses filiform, very slender.

On damp ground, San Rafael, Cal., Mar., 1880.

If the color of the fresh plant was as described it has entirely changed in the dried material. The spores are much shorter than in other species of the genus. So far as I know it has not been found since its original discovery.

Dec. 7, 1947