Hydnaceae of Iowa

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University of Iowa Studies in Natural History

G. W. MARTIN, Editor

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THE HYDNACEAE OF IOWA

BY

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AND
J. S. BOYLE

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INTRODUCTION

The family Hydnaceae, as ordinarily defined, is held to include all Homobasidiomycetes in which the hymenium is borne upon downward directed spines, warts or folds. As thus defined, most of the genera and species are clearly separated from those of related families. Intermediate forms do occur, however, grading into the Polyporaceae on the one hand and the Thelephoraceae on the other. This fact has influenced various attempts to make the boundaries of the family more distinct.

Since the time of Fries, our knowledge of the internal structure and reproduction of these fungi has been greatly increased and it has been necessary to make many changes in taxonomic treatment. The lack of agreement in current literature as to what constitutes the most precise or convenient classification is due largely to our still meager knowledge of the natural relationships among these fungi. The family has been insufficiently studied and therefore any scheme of classification applied to it must be regarded as tentative.

The removal of certain genera and species apparently related to the Polyporaceae but included in the Hydnaceae of Fries and his predecessors was first suggested in 1821 by S. F. Gray. He erected the Sistotremideae on *Sistotrema, Cerrena* and *Xylodon*, characterizing the new family as "thallus leatherlike; hymenium at first meandering, porous, becoming toothed; teeth lamellar, torn." In 1879 Karsten transferred *Irpex, Sistotrema* and *Phlebia* to the Polyporaceae. Patouillard (1900) included *Phlebia, Hydnochaete, Lopharia, Sistotrema* and species of *Irpex* among the polypores. Weir and Hubert (1918) comment on the daedaloid character of the young sporophore of *Echinodontium.*

The toothed configuration of the hymenium in *Hydnochaete, Sistotrema, Irpex* and *Echinodontium* is typically preceded by a more or less poroid configuration. This is made evident by comparing the young, growing marginal portion of a fructification with the older central portion. The flattened and irregular teeth of the older parts of a fructification are often connected by ridges which may be regarded as the remains of the pores from which the teeth were derived. The development of teeth by the breaking up of the pores is not uncommon in other genera of the Polyporaceae. It

occurs in many species of *Daedalea, Poria, Polyporus* and *Polystictus*. It would seem therefore that *Hydnochaete, Sistotrema, Irpex* and *Echinodontium* should be placed in the Polyporaceae.

Phlebia and *Lopharia* are more closely related to *Merulius* than to any genus of the Hydnaceae; they differ from *Merulius* chiefly in having the hymenial folds or ridges less anastomosed. *Phlebia* also shows close relationship to *Corticium* and thus offers a possible connecting link between the Thelephoraceae and the Polyporaceae through *Corticium* and *Merulius*. The disposition of this genus in the Merulieae of the Polyporaceae seems to be in accord with its natural relationship.

The Phylacteriaceae, erected by Patouillard in 1900 on *Caldesiella, Sarcodon* (i.e. *Hydnum*, as here defined) and *Calodon* of the Hydnaceae and *Phylacteria* and *Tomentella* of the Thelephoraceae, and characterized by its dark trama and dark, roughened spores, is recognized by such recent European writers as Bourdot and Galzin (1927) and Cejp (1928). Research has not yet shown that the hymenial configuration stressed by earlier mycologists should be subordinated to the characters upon which the Phylacteriaceae is segregated. Such hyphal and spore characters in the Basidiomycetes have generally been regarded as of generic significance only.

The group of resupinate hydnums has been least satisfactorily divided. *Odontia* was restricted by Fries in 1838 to those species chiefly characterized by crested or penicillate warts. Today the presence of cystidia is emphasized, which is a better or more exact interpretation of the character which Fries observed. *Grandinia* Fries is generally applied to the forms which have a granulose hymenium, as was probably originally intended by Fries. In order that *Grandinia* may be separated clearly from *Odontia* it must be restricted to species lacking cystidia. Although *Grandinia* Fries and *Odontia* Fries do not seem to be natural genera their use is justified because of their wide recognition and because of the fairly well defined and convenient division of resupinates which each represents.

In addition to *Odontia, Grandinia* and several other well marked resupinate genera, there still remain a number of species which have fairly conspicuous spines, no cystidia, and a texture varying from floccose to ceraceous. These species have commonly been included in the older genus *Odontia* of Persoon or in *Hydnum* tribe *Resupinatus* of Fries. *Acia* of Karsten, Rea, Bourdot and Galzin

and other European writers was restricted to the adnate, ceraceous forms only and must be rejected as a homonym, having been applied to a genus of the Rosaceae in 1791. Recognizing the necessity for a new genus name, the senior author in 1933 proposed *Oxydontia*, not knowing that Donk two years previously had assigned certain of these forms to *Mycoacia*.

The principal criteria upon which the Friesian system of classifying the hymenomycetes is based, seem yet to be workable. Many changes necessarily have been made. *Tremellodon* obviously had to be removed and placed in the Tremellales upon the discovery of its cruciately divided basidia. On equally valid grounds the removal of *Sistotrema, Irpex, Hydnochaete, Echinodontium, Phlebia* and *Lopharia* seems justified. Our present knowledge of the Hydnaceae seems to warrant the recognition of the following genera: *Caldesiella, Asterodon, Grandinia, Odontia, Mycoacia, Radulum, Mucronella, Gloiodon, Steccherinum, Auriscalpium, Hericium, Dentinum, Hydnodon, Hydnum, Calodon* and probably *Grammothele*. *Grammothele, Asterodon, Echinodontium* and *Hydnodon* have not been reported from Iowa and therefore are omitted in the following key.

The Hydnaceae in this somewhat restricted sense includes only those Homobasidiomycetes in which the hymenium is borne upon downward directed spines, teeth, or warts, which have not arisen by the breaking up of pores.

KEY TO THE GENERA OF THE HYDNACEAE

a. Fructification composed of simple or branched, clavate spines attached directly to substratum ---------- I. *Mucronella*

a. Hymenium borne on teeth, warts, or spines on the inferior surface of the hymenophore ---------- b

b. Spines borne on tough, profusely branched processes partially submerged in a brownish tomentum; resupinate or reflexed ---------- II. *Gloiodon*

b. Spines free, not immersed in brownish tomentum---------- c

c. Hymenium at first poroid, soon breaking up into coarse, irregular, flattened, sharp-edged teeth; coriaceous; spores white--------- d

c. Hymenium borne on teeth, warts or spines from the first; teeth various, but only rarely flat and sharp-edged (in *Steccherinum*) ---------- e

d. Trama white; cystidia and setae lacking---------- *Irpex*

d. Trama brown; setae present ---------- *Hydnochaete*

e. Trama pale; spores smooth or minutely echinulate, hyaline or faintly colored ---------- f

e. Trama usually dark; spores spiny or warted, usually brown, sometimes subhyaline ---------- 1
f. Hymenium usually borne on short, blunt, hemispherical or cylindrical warts, sometimes subulate and fragile; cystidia lacking; strictly resupinate ---------- III. *Grandinia*
f. Hymenium borne on low, elongate folds; subgelatinous; resupinate or reflexed ---------- *Phlebia*
f. Hymenium borne on blunt, often flattened and branched teeth; fleshy-tough; resupinate or reflexed ---------- IV. *Radulum*
f. Hymenium borne on slender spines ---------- g
g. Strictly resupinate (see also *Steccherinum*) ---------- h
g. Reflexed to applanate or pileate and stipitate ---------- i
h. Cystidia present ---------- V. *Odontia*
h. Cystidia absent ---------- VI. *Mycoacia*
i. Subfleshy to coriaceous, tough ---------- j
i. Fleshy, tender, fragile ---------- k
j. Broadly attached, sometimes resupinate, but usually with reflexed margins or lobes; sometimes applanate; rarely with definite stalk ---------- VII. *Steccherinum*
j. Stipitate; stalk slender, long; pileus unilateral; usually on pine cones ---------- VIII. *Auriscalpium*
j. Stipitate; stalk short, thick, usually central; terrestrial ----------XIII. *Calodon*, in part
k. Richly branched, or pulvinate; gleocystidia usually present; spores spherical or nearly so; on wood ---------- IX. *Hericium*
k. Terrestrial; mesopodous ---------- X. *Dentinum*
l. Resupinate, soft, floccose; on wood ---------- XI. *Caldesiella*
l. Stipitate and pileate; on ground ---------- m
m. Subfleshy; spores deep brown ---------- XII. *Hydnum*
m. Fibrous, tough; spores white to brown -------- XIII. *Calodon*, in part

I. MUCRONELLA Fries, Hym. Europ. 629. 1874; *Mucronia* Fries, Summa Veg. Scand. 329. 1849.

Type species: **Hydnum calvum** A. & S.

Subiculum absent or consisting of a floccose, fugacious mycelium; spines subulate, entire. Growing on wood and bark.

This genus is quite distinct. It resembles a small *Clavaria* or *Pterula* in general appearance but differs in its pendent spines. It is best considered a resupinate hydnum in which the subiculum has almost or quite disappeared. The name *Mucronia* is untenable, having been applied to a genus of the Polygonaceae in 1837.

KEY TO THE SPECIES OF MUCRONELLA

a. Spines gregarious but not fascicled; spores 4-7 × 2-4 μ---- 1. *M. aggregata*
a. Spines in fascicles of 2-8; spores 14-16 × 10-12 μ---------- 2. *M. Ulmi*

1. MUCRONELLA AGGREGATA Fries, Monog. Hymen. Suec. 2: 280. 1863. (Plate I, Figures 1 and 2)

Subiculum absent or consisting of a few spreading hyphae; spines 0.5-1.5 mm. in length, subulate, entire, acute, gregarious, in groups, reported white when fresh, chamois in the herbarium; cystidia absent; hyphae 2-4 μ in diameter, sometimes 6-8 μ in the interior of the spine, thin-walled, with few clamp connections, accompanied by calcium oxalate crystals; basidia 10-16 × 3-5 μ, clavate, spores 4-6.5 × 2.5-3.5 μ, ellipsoid, smooth, hyaline.

This species is recognized by the gregarious spines which are more or less distinctly separated from each other. It seems closely related to *Mucronella calva* (Alb. & Schw.) Fries, *M. minutissima* Peck, *M. abnormis* P. Henn., and *M. ramosa* Lloyd. There seems to be little difference in the microscopic structure of these species as described in the literature. A specimen labeled *M. calva* (Alb. & Schw.) from the herbarium of Bresadola at the New York Botanical Garden is identical with *M. aggregata* as here understood. Lloyd (1922) states that *M. ramosa* "is similar to *M. aggregata* except the separate plants appear as if branched." An old specimen (No. 265) in the University of Iowa herbarium answers very well to Lloyd's description and figure (Fig. 2036) of *M. ramosa* but is not sufficiently distinct from *M. aggregata* to justify specific recognition.

Rather uncommon in Iowa, collected but three times in November and once in June on decaying wood. It has also been found in Ontario, Maine, New York and Ohio.

2. MUCRONELLA ULMI Peck, Ann. Rep. N. Y. State Mus. 54: 154. 1901. (Plate I, Figures 3 and 4)

Subiculum absent; spines 1-3 mm. in length, 0.2-0.35 mm. in diameter, rarely single, usually in fascicles of 2-8, terete, subulate, acute, soft, curved, dusty dull violet with a white base, soon becoming white and mealy; hyphae 2.5-3 μ in diameter, not incrusted, with thickened walls, and few septa and clamp connections, hyaline; basidia large, 30-35 × 10-15 μ, clavate, with 4 sterigmata, accompanied by slender, hyaline and slightly projecting, paraphysoid hyphae; spores 14-16 × 10-12 μ, obovate, smooth, with a prominent apiculus, hyaline.

This species is readily recognized by its fascicled spines, its violet color and the large apiculate spores.

In the original description of *M. Ulmi* the spines are recorded

as greyish or pallid. Peck does not refer to the spore characters. Overholts (1920) made some additional notes on the same species, describing the fructification as white, drying gray and also made mention of specimens with a lavender or purplish tint. He was unable to obtain spores, however. A fungus has been collected frequently in Iowa to which the descriptions of Peck and Overholts closely apply. The spines when fresh are usually distinctly violet in color and large, lemonshaped spores are produced. Several specimens with whitish spines have been collected but these were assumed to have faded. The type of *M. Ulmi* in the New York State Museum at Albany has been examined and found to be unquestionably the same as our Iowa species. The type specimen has whitish spines and the large characteristic spores.

This fungus, although inconspicuous, is apparently common in Iowa. Collections have been made from June to November on the bark of both living and dead trunks of willow, oak, ash and elm. Not widely reported. Aside from the Iowa records its occurrence seems to be recorded only from the type locality in New York and from Pennsylvania by Overholts.

II. GLOIODON Karsten emend. Banker, Mycologia 2:10. 1910; Karsten, Medd. Soc. Faun. Fl. Fenn. 5:28. 1879, in part; *Sclerodon* Karsten, Finl. Basid. 360. 1889; *Leaia* Banker, Mem. Torrey Club 12:175.

Type species: **Hydnum strigosum** Schw.

Fructification resupinate to pileate and laterally sessile, tough, fibrous, dark, consisting of branched processes in a coarse tomentum; teeth slender, acute; spores faintly roughened, short-elliptical, hyaline. Growing on wood.

The branched processes in the pileus constitute the outstanding character of the genus and readily separate it from other genera of the Hydnaceae. Its texture, color and spore characters suggest relationship with *Auriscalpium*, from which it is sharply marked off, however, by the branching processes and the resupinate or sessile fructification.

Karsten based *Gloiodon* on *Hydnum strigosum* Schw. and two other species. Banker seems first to have emphasized the branching processes in the fructification of the type as a diagnostic generic character. Patouillard, Bresadola, Rea and others who do not recognize *Gloiodon*, associate its species generally with those of

Steccherinum as treated in this paper. However, the slightly colored hyphae, the roughened spores, and the dividing processes contrast sharply with the equivalent characters of species of *Steccherinum*.

GLOIODON STRIGOSUS (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5:28. 1879. (Plate I, Figures 5 and 6)

Hydnum strigosum Swartz ex Fries, Syst. Myc. 1:414. 1821.
Hydnum stratosum Berk. Lond. Journ. Bot. 4:307. 1845.
Sclerodon strigosus (Fries) Karst. Bidr. Finl. Nat. Folk 48: 361. 1889.
Mycoleptodon strigosum (Fries) Pat. Tax. Hymen. 117. 1900.
Leaia piperata Banker, Mem. Torrey Club. 12:175. 1906.
Leaia stratosa (Berk.) Banker, Mem. Torrey Club. 12:177. 1906.
Gloiodon stratosus (Berk.) Banker, Mycologia 2:11. 1910.

Fructification resupinate to reflexed or dimidiate, occasionally stratose from successive growths, 5 mm. or less in thickness, dry, tough, fibrous, cinnamon-brown, consisting of flexible, repeatedly branched processes which are partially submerged in a dense, coarse tomentum; margin fimbriate, from the projecting ends of the branches, or tomentose; spines 3 mm. or less in length, 0.2 mm. or less in diameter, slender, terete, acute, arising from the branched processes which they resemble in texture, mummy brown with a thin, light mineral gray surface layer when dry; hyphae 2.5-5 μ in diameter, septa widely separated, with clamp connections in the mycelial strands, faintly colored; basidia clavate; spores 4.5-5.5 × 3.5-4 μ, subspherical to elliptical, faintly roughened, hyaline.

This species may be recognized by the layer of ramifying processes which support the spines below and the dense tomentum above. It is reported as having an intensely acrid taste.

In 1897 Bresadola indicated that *Hydnum strigosum* Fries, applied to a pileate form, was identical with *Hydnum stratosum* Berk. which was based on a stratose, resupinate specimen. Banker (1906), apparently not familiar with Bresadola's paper and having never seen authentic or type material, applied *Steccherinum strigosum* to an entirely different fungus. He recognized *Hydnum* (*Leaia*) *stratosum* Berk. but applied a new name, *Leaia piperata*, to pileate forms of the same species. Later (1910, 1913) Banker became familiar with the true *Hydnum strigosum* and reported having seen the types of the species concerned. The senior author,

after studying Banker's material and the type of *Hydnum stratosum* Berk. at the New York Botanical Garden, is convinced that Bresadola's conclusions were correct.

Collected once in Iowa by Holway. This specimen is in the New York Botanical Garden. Its occurrence in Iowa has also been reported by Cejp but the specimen in the University of Iowa herbarium so determined by him is *Irpex pachyodon*. Reported from seven eastern states. A specimen sent to the senior author from Ontario was identified as this species. Apparently uncommon.

III. GRANDINIA Fries, Epicr. 527. 1838.

Type species: **Grandinia polycocca** Fries.

Fructification resupinate, thin membranaceous, soft crustaceous or ceraceous; warts or spines small, hemispherical to cylindrical or subulate, generally fragile; cystidia or cystidia-like structures lacking; spores hyaline, smooth or roughened. Growing on wood.

The distinction between *Grandinia* and related resupinate forms is not always sharp. In fact, the genus is discarded by Quélet (Fl. Myc. Fr. 432. 1888) on the ground that it is not an autonomous group but merely represents young stages of *Odontia* or forms of *Corticium*. Killermann (Engler and Prantl, 2 ed. 6:160. 1928) considers it a poor genus for the same reason. *Grandinia* does not differ essentially from *Odontia* in texture and often not in the nature and character of the spines. Its species usually are more fragile and possess shorter spines. However, these characters are not diagnostic. For example, the spines of *Grandinia raduloides* (Karsten) Bourdot and Galzin, are larger than those of *Odontia hydnoides* (Cooke and Mass.) v. Höhn. In such cases the presence or absence of cystidia alone determines the generic reference. The hymenium is generally borne over the entire surface of the hemispherical warts or cylindrical spines with obtuse apices but is often interrupted by the sterile hyphae at the apices of subulate spines. Species in which these sterile hyphae project prominently either singly or in bundles are referred to *Odontia*. *Grandinia* differs from *Corticium* in the possession of spines or warts but this distinction is not always sharp. A young fructification of a species of *Grandinia* may occasionally be quite smooth or *Corticium*-like, or a species of *Corticium* may possess a colliculose or slightly granular hymenial surface suggesting true warts.

Grandinia was erected on seven species, of which the first men-

tioned by Fries, *G polycocca* Fries, is designated the type by Banker (1902). Clements and Shear (1931) cite *G. granulosa* Fries as the type, a most unfortunate choice, since that species is quite different from other species at present included in *Grandinia*.

KEY TO THE SPECIES OF GRANDINIA

a. Subhymenial layer bearing antler-like, dichotomously branched, thick-walled hyphal structures ---------- 1. *G. granulosa*
a. Hyphae not antler-like, relatively thin-walled ---------- b
  b. Spores minutely but distinctly echinulate---------- c
  b. Spores smooth, rarely slightly roughened---------- d
c. Fructification soft membranaceous, pruinose, white to light buff; basidia clavate; spores 3-4 × 2.5-4 μ, subspherical---- 2. *G. farinacea*
c. Fructification ceraceous, whitish to tilleul-buff, becoming isabelline in the herbarium; basidia urniform; spores 3-4.5 × 2.5-4 μ, ovoid to subspherical ---------- 3. *G. alnicola*
  d. Basidia with 4-6-8 sterigmata; spores cylindrical or fusiform ---------- e
  d. Basidia with 2-4 sterigmata; spores subspherical or elliptical ------ f
e. Hyphae and basidia guttulate; spores 7-8 × 3-4 μ--------- 4. *G. raduloides*
e. Hyphae and basidia not guttulate; spores 3-5 × 2-3 μ---- 5. *G. Brinkmanni*
  f. Fructification separable; teeth hemispherical, collapsing in drying ---------- 6. *G. helvetica*
  f. Fructification adnate; teeth hemispherical to short cylindrical, with obtuse crests, not collapsing in drying------ 7. *G. mutabilis*

1. GRANDINIA GRANULOSA Fries, Epicr. 527. 1838.

Asterostromella granulosa (Fries) Bourd. & Galz. Hymén. Fr. 396. 1928. (Plate I, Figure 7)

Fructification effused, adnate, thin, subceraceous or crustaceous, slightly pruinose, not cracking, warm buff to cinnamon-buff; margin similar; warts hemispherical, crowded; hyphae 3-5 μ in diameter, dichotomously branched and antler-shaped, with thick walls, subhymenial hyphae indistinct; basidia 14-20 × 4-5 μ; spores 5-6 × 3.5-4 μ, ellipsoid, smooth, hyaline.

This species is characterized by the numerous thick-walled, antler-shaped hyphal structures. This character is made diagnostic for the genus *Asterostromella* v. Höhn. & Litsch. Apparently the subhymenial hyphae accompanying the specialized hyphae are thin-walled and very fragile or undergo some transformation for they always appear indistinct under the microscope.

G. granulosa Fries apparently has never been collected in Iowa but is here included since the state lies within its geographic limits.

This description is given also in order to show its relationship to *Grandinia mutabilis* to which the same specific name has occasionally been applied.

G. granulosa is reported from scattered localities in the eastern United States, but it is doubtful whether in every case the reports refer to the species here described. Only a small number of the forty or fifty specimens labeled *G. granulosa* examined at the New York Botanical Garden were correctly determined.

2. GRANDINIA FARINACEA (Fries) Bourd. & Galz. Bull. Soc. Myc. France 30: 253. 1914. (Plate I, Figure 8)

Hydnum farinaceum Pers. ex Fries, Syst. Myc. 1: 419. 1821.
Hydnum niveum Pers. ex Fries, Syst. Myc. 1: 419. 1821.
Odontia nivea (Fries) Quél. Fl. Myc. France 435. 1888.
Odontia farinacea (Fries) Bres. Atti Accad. Rovereto III. 3: 99. 1897. *non* Quélet. 1888.

Effused, adnate, extremely thin when young, becoming somewhat thicker with age, arachnoid under the lens, soft membranaceous, pruinose, white to light buff; margin byssoid or pruinose, white; teeth 2 mm. or less in length, crowded, slender, subulate, fragile, terminating in a bundle of sterile hyphae; trama with calcium oxalate crystals; hyphae 2-4 μ in diameter, fragile, with clamp connections, occasionally swollen at the septa; basidia 12-24 × 3-5 μ, clavate, with 2-4 sterigmata; spores 3-4 × 2.5-4 μ, subspherical, minutely echinulate, hyaline.

This species, while closely resembling *G. Brinkmanni* in color and texture, is readily distinguished by the subspherical, echinulate spores and the longer, more crowded subulate teeth. The powdery masses of conidia which frequently occur on or near the margin of the fructifications offer an additional distinctive character which may at times prove helpful for field identification. The teeth in Iowa specimens usually do not exceed 1 mm. in length.

Common in Iowa on much decayed coniferous and deciduous wood; collected in all seasons; mostly April to November. This species is common throughout the eastern and central United States.

3. GRANDINIA ALNICOLA Bourd. & Galz. Bull. Soc. Myc. France 30: 254. 1914. (Plate I, Figure 9)

Fructification effused, adnate, extremely thin, ceraceous, usually not cracking, whitish to tilleul-buff, becoming at times isabelline in

the herbarium; margin similar or pruinose; warts very small, short-cylindrical, slender, fragile, scattered to crowded, occasionally absent; hyphae thin-walled, 2-3 μ, indistinct, with scattered clamp connections; basidia 8-20 × 4-5.5 μ, slightly swollen at the base, with 2-4 prominent sterigmata; spores 3-4.5 × 2.5-4 μ, ovoid to subspherical, minutely echinulate, usually 1-guttulate, abundant.

This species closely resembles *Grandinia mutabilis* in macroscopic appearance, but it can readily be separated microscopically by its minutely echinulate, ovoid spores. Fairly common in Iowa. A specimen from Ohio indicates its occurrence in that state.

4. GRANDINIA RADULOIDES (Karst.) Bourd. & Galz. Hymén. France 412. 1928. (Plate I, Figure 10)

Hydnum raduloides Karst. Medd. Soc. Faun. Fl. Fenn. 9:110. 1883.

Fructification effused, soft, floccose-pruinose, adherent, white to pale pinkish buff; margin similar, thinning out; teeth 1.5 mm. or less in length, cylindrical or subulate, moderately slender to rather stout, terete, pruinose, with a reddish tint at the apices when dry; hyphae 3-5 μ in diameter, thin-walled, becoming guttulate, with clamp connections, more densely compacted in the teeth than in the base of the fructification; context often with large, scattered, calcium oxalate crystals; basidia 15-25 × 5-8 μ, urn-shaped, becoming guttulate, basal portion swollen, with 6-8 prominent sterigmata; spores 7-8 × 2.75-3.5 μ, fusiform, smooth, hyaline.

This fungus, while resembling *G. Brinkmanni* and *G. muscicola* (Pers.) Bourd. & Galz. in the possession of urnshaped basidia with 6-8 sterigmata, is readily separated from them by its soft, floccose-pruinose texture, guttulate tramal hyphae and basidia, and by its larger spores.

Grandinia raduloides is not widely reported from this country. The senior author reports no trace of this species in the Lloyd herbarium at Washington, D. C., although Bourdot and Galzin report a specimen from C. G. Lloyd (no. 1444).

Collections have been made twice in Iowa, at Estherville in August, 1931, and at North Liberty in May, 1937, on much decayed, decorticate, deciduous wood. It has been collected also in Montana.

5. GRANDINIA BRINKMANNI (Bres.) Bourd. & Galz. Bull. Soc. Myc. France 30: 252. 1914. (Plate II, Figure 11)

Odontia Brinkmanni Bres. Ann. Myc. 1: 88. 1903.
Grandinia crustosa Vel. Ceské Houby. 734. 1922. (fide Cejp.)

Fructification effused, adnate, extremely thin when young, becoming somewhat thicker, sub-crustaceous, arachnoid under the lens, pruinose, pale smoke gray to nearly white; margin indeterminate, sometimes pruinose or minutely fibrillose; teeth 1 mm. or less in length, very fragile, varying from obtuse warts to short, acute teeth, sometimes absent in small areas; context with calcium oxalate crystals; hyphae 2-4 μ in diameter, fragile, indistinct; basidia 10-12-24 × 3-6 μ, clavate or urn-shaped, with 4-6-8 sterigmata; spores 3-5 × 2-2.5 μ, short cylindrical, slightly curved, smooth, hyaline.

This species is characterized by its thin, whitish, arachnoid subiculum, minute warts and urn-shaped basidia which often have 6-8 sterigmata. It seems related to certain of the thin forms of *Corticium* such as *C. calceum* Fries and *C. octosporum* Schroet.

Iowa specimens agree well with a specimen from Bresadola's herbarium, now at the New York Botanical Garden, and several specimens from Bourdot, now at the Farlow Herbarium and in the C. G. Lloyd Mycological Collection.

Fairly common in Iowa. Collected from March to December on much decayed coniferous and deciduous wood. Reported from the eastern United States. Two specimens from Manitoba indicate its occurrence in Canada.

6. GRANDINIA HELVETICA (Pers.) Fries, Hymen. Europ. 627. 1874. (Plate II, Figure 12)

Hydnum helveticum Pers. Myc. Europ. 2: 184. 1825.
Corticium tomentelloides v. Höhn. & Litsch. Akad. Wiss. Wien Sitzungsber. 116: 824. 1907.

Fructification effused, thin, separable, floccose-mealy, with a subceraceous hymenial pellicle supported on a loose fibrillose subiculum, stretching in drying and breaking in places, cream color; margin fibrillose, the fibrils branching and running over the substratum; spines wart-like, hemispherical or dome-shaped, giving to the hymenial surface a colliculose appearance, considerably flattened in drying; hyphae 3.5-7 μ in diameter, thin-walled, with scattered

clamp connections forming rope-like strands, 7-20 μ in diameter, which run over the substratum; basidia 15-30 × 5-7 μ, short, thick, with 4 sterigmata; spores 3.5-5 μ, spherical or subangular, smooth, hyaline, 1-guttulate.

This species is recognized by its thin, soft, separable membrane, the colliculose hymenium and the slender, branching fibrils. It resembles certain of the thin, membranaceous species of *Corticium*, approaching closely *C. arachnoideum* Berk.

Collected twice in Iowa, in Iowa City in December, 1931, and December, 1941, on oak. Apparently not widely reported from the United States. A specimen of this species labeled *Grandinia membranacea* Ellis & Ev. from Canada, collected by Macoun in 1898, was found in the mycological herbarium of the New York Botanical Garden. Our specimens agree with specimens determined by Bourdot and Miss Wakefield and with the description of the type by Bourdot (1932).

7. GRANDINIA MUTABILIS (Pers.) Bourd. and Galz. Bull. Soc. Myc. France 30:250. 1914. (Plate II, Figure 13)

Hydnum granulosum var. *mutabile* Pers. Myc. Europ. 2:184. 1825. *non G. granulosa* Fries.
Odontia olivascens Bres. Fungi Trid. 2:36. 1892.
Corticium sulphurellum v. Höhn. & Litsch. Oest. Cort. 66. 1907.
Odontia mutabilis (Pers.) Bres. Ann. Myc. 9:426. 1911.
Grandinia granulosa (Pers.) Bourd. & Maire, Bull. Soc. Myc. France 36:74. 1920. *non G. granulosa* Fries.
Grandinia Abrotani Vel. Ceské houby 734. 1922. (fide Cejp).

Fructification effused, adnate, at first very thin, becoming thicker, ceraceous, not cracking, whitish to tilleul-buff, becoming at times isabelline or greenish in the herbarium; margin similar or pruinose; warts more or less uniformly hemispherical to short cylindrical, fragile, scattered to crowded, occasionally few or absent; hyphae 3-6 μ, irregularly branched, with occasional clamp connections, not incrusted; basidia 15-20 × 6-7.5 μ, clavate; spores 4-5.5 × 3.5-4.5 μ, subspherical, smooth, rarely slightly roughened, apiculate, hyaline.

The thin, ceraceous fructification, the undifferentiated margin and the uniform, obtuse warts which do not collapse upon drying, are useful characters in the determination of this species.

Thelephora granulosa was described by Persoon in 1801. In 1825 he transferred it to the genus *Hydnum* and recognized several

varieties. Form *mutabile*, according to Bourdot and Maire (1920), applied to specimens that have become "jaunissant ou verdissant" in the herbarium. Donk (1930) and Bourdot (1932), however, indicate that *mutabile* and *granulosa* Pers. do not represent the same species. *Grandinia granulosa* Fries is based on a species having a similar fructification but differing sharply in the possession of antler-shaped or dichotomously branched structures in the context and trama. *G. granulosa* (Pers.) Bourd. & Maire and *G. granulosa* Auct. also appear in the literature.

Collected three times on deciduous and coniferous wood near Milford, Iowa, in August. A specimen from Ontario, Canada, indicates the occurrence of this species there. Apparently uncommon in North America.

IV. RADULUM Fries, Elenchus Fung. 1:148. 1828; *Phaeoradulum* Pat. Tax. Hymén. 69. 1900; *Tylodon* Banker, Bull. Torrey Club 29:440. 1902.

Type Species: **Radulum orbiculare** Fries.

Fructification resupinate, rarely reflexed, fleshy-ceraceous; teeth blunt, generally coarse, deformed, irregularly scattered or confluent. Growing on wood.

The species of *Radulum* are exceedingly variable in the expression of external characters. Microscopic structures must be noted for successful classification. For the few species found in Iowa, the spore characters prove helpful. Members of this genus show some relationship with certain of the fleshy or waxy species of *Corticium* which exhibit at times a colliculose hymenium or widely and irregularly scattered humps as in *C. tuberculatum* Karsten, *C. cremoricolor* Berk. & Curt. and *C. hydnans* (Schw.) Burt. The exact dividing line between *Radulum* and *Corticium*, therefore, is not always sharp. It seems best to refer to *Corticium* those forms in which humps sometimes occur irregularly or appear merely as slightly raised areas on the hymenial surface.

Banker (1902) designated *Radulum pendulum* Fries, Elench. Fung., as the type of this genus. This species is regarded by Bourdot and Galzin as a form of *Corticium subcostatum* (Karst.) B. & G. Clements and Shear (1931) cite *Radulum orbiculare* Fries as the type. The latter species is widely distributed and a typical representative of the genus.

KEY TO THE SPECIES OF RADULUM

a. Fructification narrowly reflexed, sometimes resupinate, clamp connections numerous; spores 5-7 × 3-4 μ; often found on charred wood ---------- 1. *R. pallidum*

a. Fructification resupinate, clamp connections present or absent, spores usually larger ---------- b

b. Clamp connections few or absent; spores 6-8 × 3-4 μ--- 2. *R. quercinum*

b. Clamp connections numerous; spores 8-12 × 3-4 μ, curved ---------- 3. *R. orbiculare*

1. RADULUM PALLIDUM Berk. & Curt. Grevillea 1: 145. 1873.
(Plate II, Figure 14)

Resupinate to narrowly reflexed, tomentose and white on the upper surface; orbicular at first, then confluent and appearing slightly effused, adnate, ceraceous, moderately thick, sometimes cracking in drying, pinkish buff to vinaceous-buff and vinaceous-fawn; margin tomentose, concolorous to white; teeth variable, short, obtuse, smooth or slightly fimbriate, often confluent in irregular groups; hyphae 2-4.5 μ, distinct, with numerous clamp connections, more or less parallel along the substratum and ascending obliquely to the compact hymenium, hyaline or granular; basidia 15-33 × 4-7 μ, clavate, with 4 sterigmata; spores 5-7 × 3-4 μ, ellipsoid, obliquely attenuated, slightly depressed laterally, smooth, hyaline.

This species resembles *R. quercinum* Fries as that species is known in Europe. It seems to differ, however, in its often reflexed margin, the abundance of clamp connections and the slightly smaller spores. Resupinate specimens of *R. pallidum* can usually be distinguished by the vinaceous tinge of the hymenium, and the thicker and less cracked fructification. As is true in other species of *Radulum*, these macroscopic characters are exceedingly variable.

This species seems also to be known as *R. orbiculare* Fries in this country. Lloyd clearly and accurately separates the two in his paper, *The genus Radulum*, 1917, but in a later paper (Myc. Writ. 1079. 1921) he considers *R. pallidum* as merely an American representative of *R. orbiculare*. However, the longer, curved spores, together with the invariably resupinate fructification and the softer, ceraceous texture, seem clearly to separate *R. obiculare*. Iowa specimens are identical with a specimen at the New York Botanical Garden which Banker compared with the type and with Lloyd's material.

Abundant in Iowa on decaying wood and bark of oak and other

frondose species. Collected throughout the year. Often found on charred wood. Its occurrence is widely reported from the United States.

2. RADULUM QUERCINUM Fries, Hymen. Eu. 623. 1874.
(Plate II, Figure 15)

Hydnum quercinum Fries, Syst. Myc. 1:423. 1821.
Hydnum fagineum Pers. ex Fries, Syst. Myc. 1:433. 1821.
Sistotrema fagineum Pers. Myc. Eu. 2:194. 1825.
Radulum fagineum Fries, Elench. Fung. 1:152. 1828.

Fructification resupinate, orbicular, becoming confluent and effused, sometimes subdecorticating, crustaceous, adherent, often cracking in drying, cinnamon-buff to clay color; margin thin, similar or slightly villose, usually lighter in color; teeth variable, short and obtuse to long, cylindrical and slightly pointed; hyphae 2-5 μ in diameter, mostly thin-walled, with few clamp connections; basidia clavate, with 2-4 sterigmata; spores 6-8 × 3-4 μ, ellipsoid to short cylindrical, depressed laterally, smooth, hyaline.

The European descriptions of *R. quercinum* Fries indicate a fungus very near to *R. pallidum* Berk and Curt. Six specimens of *R. quercinum* Fries from Litschauer, Bourdot and Bresadola were examined at the New York Botanical Garden and the Farlow herbarium and seemed distinct. The hyphae lack the characteristic clamp connections of *R. pallidum* the spores are slightly longer, and the thin, adnate, resupinate fructifications are cracked to the substratum. There is little suggestion that this type of fructification may occur reflexed as in *R. pallidum*.

Rare in Iowa. Collected in October on deciduous wood. Schweinitz reports the occurrence of *Hydnum quercinum* Fries from Pennsylvania.

3. RADULUM ORBICULARE Fries, Elench. Fung. 1:149. 1828.
(Plate II, Figure 16)

Hydnum Radula Fries, Syst. Myc. 1:422. 1821.
Sistotrema Radula Pers. Myc. Eu. 2:195. 1825.

Resupinate, orbicular, becoming confluent, soft ceraceous, light ochraceous buff; margin similar or byssoid and white; teeth variable, conical to cylindrical or platelike, obtuse, scattered or fascicled; hyphae 2-4 μ in diameter, distinct, with numerous clamp connections, not arranged in distinct zones; basidia 20-30 × 5-6 μ, clavate,

with 4 sterigmata; spores 8-12 × 3-4 μ, cylindrical, curved, smooth, hyaline.

The large, curved, cylindrical spores clearly separate *R. orbiculare* Fries from the other Iowa species of *Radulum*. This species seems close to *Radulum hydnans* Schw. and *Corticium colliculosum* Berk. & Curt. Burt regards these two as synonyms and belonging to the genus *Corticium*. He states that *Corticium hydnans* (Schw.) may be distinguished in doubtful cases from *R. orbiculare* Fries by the absence of gloeocystidia. This is not a sufficiently good character, however, since the frequently visible, projecting structures are not gloeocystidia in the strict sense. The spore size as recorded by Burt is considerably smaller for *Corticium hydnans*.

Probably fairly common in Iowa. Collected on deciduous wood from April to September. Widely distributed in the United States.

V. ODONTIA Pers. emend. Fries. Epicr. 528. 1838; *Kneiffia* Fries, Epicr. 529. 1838; *Dacryobolus* Fries, Summa Veg. Scand. 404. 1849; *Grandiniella* Karsten, Hedwigia 34:8. 1895; *Kneiffiella* Underwood, Bull. Torrey Club. 24:205. 1897; *Neokneiffia* Sacc. Tab. Com. Gen. Fung. 11. 1898; *Pycnodon* Underwood, Bull. Torrey Club. 25:431. 1898; *Etheirodon* Banker, Bull. Torrey Club. 29:441. 1902; *Hydnopsis* Rea, Brit. Basid. 650. 1922.

Type species: ***Hydnum fimbriatum*** Pers.

Resupinate, membranaceous, floccose, crustaceous or rarely ceraceous, sometimes pruinose; spines variable, conical to subulate or cylindrical, typically divided or penicillate; cystidia always present; spores variable. Growing on wood.

The presence of cystidia is diagnostic for this genus for it is the only strictly resupinate genus of the Hydnaceae possessing them. Cystidia are readily separated from gloeocystidia, setae and conducting organs but are often distinguished with difficulty from the sterile hymenial organs known as paraphyses. Sterile hymenial organs which are readily distinguished from basidia are here treated as cystidia. Overholts (1929) states, "a cystidium is generally regarded as the specialized end of an undifferentiated hypha and typically has thickened walls, no conspicuous content and is often incrusted with granular material." Even so, it seems unwise to distinguish arbitrarily between the unspecialized hyphae and typical cystidia projecting at the crest of the teeth in many species of

Odontia, particularly since this character may vary in a given species. These structures may occur singly or in loose to compact bundles. Forms in which the projecting fascicles of cystidia may be little more than unspecialized hyphal ends, as in *Odontia Pruni* Lasch. and *Odontia cristulata* Fries, represent a transition to the condition in certain species of *Grandinia,* for example *G. farinacea* Fries, in which the spines are terminated by sterile but non-projecting hyphae. *Odontia* is separated from *Mycoacia* and *Grandinia* by the presence of cystidia and *Peniophora* of the Thelephoraceae by the spiny configuration of the hymenium. Resupinate specimens of *Steccherinum ochraceum, S. setulosum* and *S. laeticolor* may sometimes be referred erroneously to *Odontia,* for they, too, have cystidia. However, these forms can be distinguished generally by their more coriaceous texture and larger size.

Odontia was established by Persoon in 1794 on two resupinate species. Later in 1801 and 1825, he reduced this genus to the rank of a subgenus of *Hydnum* and apparently included all the resupinate hydnoid species known to him. Persoon's division *Odontia* of *Hydnum* in this sense was synonymous with the tribe *Resupinatus* of the same genus as treated by Fries in the Systema Mycologicum. S. F. Gray (1821) was the first post-Friesian writer to recognize *Odontia* Pers. as a distinct genus. He cites two species, the identity of which is not known to the authors. A number of attempts have been made to divide this rather large group of resupinate species into smaller and more natural or convenient genera. In 1838 Fries erected *Grandinia* and *Odontia* on certain of these species, the remaining species were retained in the tribe *Resupinatus* of *Hydnum.* The multifid or penicillate character of the crests of the spines noted by Fries in the original description of *Odontia* apparently is due largely to the projecting cystidia. Cystidia, therefore, have become the distinguishing character of the genus in the modern sense rather than the multifid or penicillate character in gross appearance. Many species have since been transferred to *Odontia* Fries even though the cystidia are inconspicuous and visible only under the microscope. *Odontia* Fries in this sense corresponds to *Peniophora* of the Thelephoraceae.

Kneiffia also was established by Fries in 1838 as a new genus of the Hydnaceae, based on *Thelephora setigera* Fries. It seems that conspicuous cystidia again serve as the diagnostic character. The genus was not adequately distinguished in the original description

nor do the characters of the species included seem to justify such a separation. Therefore, following Patouillard (1900), *Kneiffia*, in this paper, is relegated to synonymy. *K. setigera* Fries is known in Europe as *Peniophora setigera* (Fries) Bres. Its reference to *Peniophora* does not seem to be justified in view of the fact that the hymenial surface usually appears papillate.

KEY TO THE SPECIES OF ODONTIA

a. Cystidia elongate, fusiform or cylindrical, usually strongly incrusted, with thickened walls ---------- b
a. Cystidia not as above, variable, if notably elongate either smooth or slightly incrusted, or sometimes heavily incrusted, thin-walled, and obscured in axial bundles ---------- g
b. Cystidia distinctly fusiform ---------- c
b. Cystidia mostly long cylindrical ---------- d
c. Cystidia sometimes arising from a specialized, septate, incrusted, axial hypha; spores short cylindrical, 3.5-5 × 1.5-2 μ ---------- 1. *O. hydnoides*
c. Cystidia not arising from a specialized hypha; spores oblong, 4.5-5.5 × 3-3.5 μ ---------- 2. *O. Queletii*
d. Cystidia largely restricted to the apex, usually 1-6 per tooth, septate, smooth, then strongly incrusted; spores mostly 9 × 4.5 μ ---------- 3. *O. setigera*
d. Cystidia numerous, projecting from the sides and apices, not septate; spores not exceeding 5 × 3 μ ---------- e
e. Fructification separable, with numerous rhizomorphic strands; teeth short, hispid; spores 3.5-4.5 × 2-3 μ ---------- 4. *O. fimbriata*
e. Fructification adnate, without rhizomorphic strands; teeth slender ---------- f
f. Ceraceous; hyphae 2-4.5 μ, with few cross-walls; spores 4-5 × 2-3 μ ---------- 5. *O. ciliolata*
f. Floccose, with a fragile, pruinose hymenial surface; hyphae 5-7 μ, with many septa; spores 3-3.5 × 1.75-2.25 μ ----------6. *O. laxa*
g. Spores long, cylindrical; cystidia cylindrical, relatively undifferentiated, projecting prominently, smooth, in compact or loose terminal tufts ---------- h
g. Spores spherical to short cylindrical; cystidia as in above (g) or otherwise ---------- k
h. Cystidia agglutinated by a resin-like material into a more or less compact, cylindrical or conical, viscid fascicle; spores 5-7 × 1-1.5 μ ---------- 7. *O. sudans*
h. Cystidia in loose tufts, little more than slightly swollen hyphae projecting at the apices of the teeth ---------- i
i. Subceraceous, whitish; spines conical, minute; cystidia loosely fascicled, lightly incrusted with spherical clusters of crystals; spores 6-7 × 2-2.5 μ, flattened on one side ---------- 8. *O. cristulata*

i. Subfloccose, near cinnamon-buff; cystidia not incrusted; spines larger ---------- j

j. Basidia 10-20 × 4-5 μ; spores 7-9 × 1.5-2 μ, curved ------ 9. *O. alutacea*

j. Basidia 18-35 × 5-7 μ; spores 7-10 × 3-4 μ, slightly curved ---------- 10. *O. albicans*

k. Cystidia not restricted to the apical portions of the teeth, consisting of subulate, paraphysoid structures or with enlarged or incrusted terminations; not greatly extended ---------- l

k. Cystidia more or less restricted to the apical or outer portion of the teeth ---------- n

l. Cystidia subulate, thin-walled, not incrusted, of the same diameter as the basidia, barely projecting from hymenium; spores 6-8 × 3-4 μ ---------- 11. *O. crustosa*

l. Cystidia with terminal incrustations ---------- m

m. Cystidia terminated by a globose enlargement, usually with radiating crystals; spores 4.5-6 × 2.5-3 μ ---------- 12. *O. bicolor*

m. Cystidia consisting of constricted hyphal ends which are incrusted for a distance of 8-12 μ; spores 5-6 × 4-5 μ --------- 13. *O. arguta*

n. Cystidia incrusted, thin-walled and relatively unspecialized, arising singly or in compact bundles at the apical region of the tooth, becoming quite conspicuous in KOH-Phloxine solution ---------- o

n. Cystidia smooth or occasionally with scattered crystalline material, often in loose terminal tufts ---------- r

o. Teeth irregular, obtuse, terminating in white, divided tips ---------- p

o. Teeth entire, uniformly conical or cylindrical, often with pointed tips ---------- q

p. Fructification honey yellow; teeth rigid, strongly hispid at the apices; spores 6-9 × 3.5-5 μ, faintly yellow in mass ---------- 14. *O. livida*

p. Fructification cream buff; teeth short, weakly divided into whitish processes; spores 4-6 × 3-3.5 μ, white in mass ---------- 15. *O. crustula*

q. Fructification dark-gray to burnt umber when fresh, cinnamon-buff to fuscous-black in the herbarium; spores 4.5-6 × 2-3 μ ---------- 16. *O. fusco-atra*

q. Fructification mustard yellow to tawny, turning purple upon contact with KOH; spores 4.5-6 × 2-3.5 μ ---------- 17. *O. uda*

r. Fructification soft, floccose, loosely adnate ---------- s

r. Fructification crustaceous, subceraceous or ceraceous, adnate ---------- t

s. Teeth bristly on the sides and apices, 4 mm. or less in length; cystidia 3-10 μ in diameter, numerous, long cylindrical, thick-walled; spores 4-7 × 2.5-4.5 μ ---------- 18. *O. Barba-Jovis*

s. Teeth with one or more pointed terminal tufts of minute cys-

tidia; 2.5-4 μ in diameter, long cylindrical; spores 4-6 × 3-4 μ ---------- 19. *O. stipata*

t. Fructification mars yellow to mars brown; teeth coalesced, and strongly fimbriate at the apices; spores 3-4.5 × 1.5-2.5 μ ---------- (*Mycoacia stenodon*)

t. Cartridge buff to light ochraceous buff; teeth 1.5 mm. or less in length, variable, subulate, cylindrical or spathulate; spores 4-6 × 2.5-4 μ ---------- 20. *O. spathulata*

1. ODONTIA HYDNOIDES (Cooke & Massee) v. Höhn. Akad. Wiss. Wien. Sitzungsber. 118: 817. 1909. (Plate II, Figure 17)

Peniophora hydnoides Cooke & Massee, Journ. Linn. Soc. 25: 154. 1888.

Odontia conspersa Bres. Accad. Sci. Lett. Rovereto III. 3: 100. 1897.

Peniophora crystallina v. Höhn. & Litsch. Akad. Wiss. Wien. Sitzungsber. 116: 828. 1907.

Effused, thin, adnate, ceraceous, then farinaceous, white to yellow or cinnamon-buff; margin indistinct; teeth 0.5 mm. or less in length, subulate to cylindrical, variable, generally slender and fragile, subdistant, with prominent projecting cystidia at the sides and crest; hyphae 2-3 μ in diameter, indistinct, no clamp connections seen; cystidia 25-70 × 8-14 μ, subulate to fusiform, with thick and strongly incrusted walls, occasionally more or less fascicled about an axial cystidium (incrusted, septate, 8-10 μ in diameter) which projects quite prominently at the crest; basidia 8-15 × 3-5 μ, subulate, with 4 sterigmata; spores 3.5-5 × 1.5-2 μ, short cylindrical, slightly depressed on one side, smooth, hyaline.

This species is quite readily recognized by its extremely thin fructification, slender, fragile spines and the more or less imbricated cystidia. It is separated from *Odontia Queletii* by its more slender spines and smaller, cylindrical spores. The peculiar axial row of large incrusted cells in a single tooth around which the numerous subulate or fusiform cystidia are sometimes arranged, is also a helpful character. A slightly crushed or carefully cut free-hand section of a spine will reveal this structure. Von Höhnel has indicated that this species at times may be nearly devoid of teeth.

This species does not agree with the original description and figures of *Peniophora hydnoides* Cooke & Massee. Von Höhnel (1909), however, studied the original specimen and reported that

it represented the same species as *Odontia conspersa* Bres. and *Peniophora crystallina* v. Höhn. & Litsch. The senior author has studied an authentic specimen of *Odontia conspersa* from Bresadola, at the New York Botanical Garden, and regards it as identical with Iowa specimens. The synonymy of these two names is quite generally accepted in Europe.

This fungus is common in Iowa, occurring from June to November on decaying coniferous and deciduous wood. It is widely distributed in the United States and Canada.

2. ODONTIA QUELETII Bourd. & Galz. Bull. Soc. Myc. France 30:270. 1914. (Plate II, Figure 18)

Odontia farinacea Quél. Fl. Myc. France 435. 1888.

Fructification ceraceous or subcrustaceous, extremely thin, cracking slightly or not at all, white to cinnamon-buff; margin absent, not distinct or narrowly limited and fibrillose; teeth scattered or confluent in groups, subulate to short cylindrical, obtuse, fimbriate; hyphae 2.5-5 μ in diameter, with thin walls, fragile, indistinct; cystidia 40-100 × 8-16 μ, with thick, incrusted walls, usually fusiform but occasionally cylindrical or clavate at the crest, numerous, projecting prominently, subimbricate in the teeth; basidia 15-30 × 3.5-5 μ, cylindrical-clavate; spores 4.5-5.5 × 3-3.5 μ, oblong, smooth hyaline, 1-2 guttulate.

The description of Bourdot and Galzin, and that of Quélet in part, indicates a crustaceous fructification which cracks upon drying, more crowded spines, smaller cystidia and non-guttulate spores. These differences, however, may not be significant and since the species is quite distinct otherwise, the determination is probably accurate. An authentic specimen from Bourdot at the Farlow herbarium resembles our Iowa collections macro- and microscopically.

Odontia Queletii and *Odontia hydnoides* are sharply distinguished from other species of *Odontia* by the numerous, thick-walled, incrusted and projecting fusiform cystidia, and by the small spores. *O. Queletii* may be separated from the latter by the slightly larger, guttulate spores and the stouter, less crowded teeth. The young growing borders of the fructification spread out as a very thin layer which is almost invisible under the lens. In these areas the cystidia stand out as prominent upright structures.

Uncommon in Iowa. Collected four times on deciduous wood near

Milford, Iowa, in June and July. Two specimens collected in April and November in Manitoba were identified as this species.

3. ODONTIA SETIGERA (Fries) Miller, Mycologia 26 : 19. 1934. (Plate III, Figure 19)

Thelephora setigera Fries, Elench. Fung. 1 : 208. 1828.
Kneiffia setigera Fries, Epicr. 529. 1838.
Corticium myxosporum Karst. Medd. Soc. Faun. Fl. Fenn. 9 : 53. 1882.
Odontia acerina Peck, Ann. Rep. N. Y. State Mus. 53 : 847. 1900.
Peniophora setigera (Fries) v. Höhn. & Litsch. Ann. Myc. 4 : 289. 1906.

Effused, adnate, at first thin, arachnoid under the lens, then thickening, subfloccose to subceraceous, sometimes cracking, white to pinkish buff; margin similar, white; teeth short, conical, blunt, sometimes with one or more prominently projecting cystidia, to weakly hispid at the apex; hyphae 2-5 μ in diameter, with numerous clamp connections, loosely arranged; cystidia 25-100 × 6-11 μ, cylindrical, sometimes tapering, septate, with clamp connections, projecting prominently near the apex of the teeth, at first naked, becoming incrusted with coarse crystals; basidia 15-35 × 5-8 μ, clavate, with 4 sterigmata; spores 6-12 × 3.5-6 μ, mostly 9 × 4-5 μ, ellipsoid to cylindrical, smooth, hyaline, sometimes granular, often guttulate.

This species is generally referred to *Peniophora* in Europe. Smooth forms have been reported, but these are apparently unusual. The hymenium in our Iowa specimens and in the dozens of specimens from Europe and North America examined at the New York Botanical Garden and the Farlow herbarium is either distinctly toothed or at least papillose or warty. The odontoid character of the fructification is also shown by the usual position of the cystidia at or near the apex of the small, conical teeth. A free-hand cross-section through a tooth of *Odontia granulata*[1] with a single cystidium is shown by Overholts (1929) on Plate 1, figure 5. In forms with less pronounced warts the cystidia appear more scattered but this is not unusual in other species of *Odontia*. If the present distinctions between *Peniophora* and *Odontia* are to be maintained, this species seems clearly to belong to the latter genus.

Odontia setigera may be distinguished from *O. cristulata*, the

[1] *Odontia granulata* is the name suggested by Burt but apparently never published. References have been made to it in literature by Lloyd and Overholts, but it is *O. setigera* as here understood.

species which it most nearly approximates, by the larger, more conspicuous and less fascicled cystidia and by the larger spores.

Extremely common in Iowa on wood or bark of oak and many other frondose and coniferous species. Collected from June to December. Widely distributed in the United States.

4. ODONTIA FIMBRIATA Fries, Epicr. 529. 1838. (Plate III, Figure 20)

Hydnum fimbriatum Pers. ex Fries, Syst. Myc. 1: 421. 1821.
Mycoleptodon fimbriatum (Fries) Bourd. & Galz. Bull. Soc. Myc. France 30: 276. 1914.
Gloiodon fimbriatum (Fries) Donk, Ned. Bot. Ver. 1: 79. 1930.

Effused, membranaceous, coriaceous, separable, surface plainly marked by intricately branching, rhizomorphic strands, vinaceous-buff to fawn colored; margin fibrillose and rhizomorphic; spines small, short, wart-like to conical, hispid at the apices, crowded to subdistant, more crowded over the rhizomorphic strands; subicular hyphae of two kinds, but mostly thick-walled, indistinct and with occasional clamp connections in the subhymenial region; cystidia 50-80 × 7-9 μ, clavate to cylindrical, obtuse, thick-walled, incrusted, greatly elongated; basidia 12-20 × 3-5 μ, clavate, with 4 sterigmata; spores 3.5-4.5 × 2-3 μ, elliptical, smooth, hyaline.

This species is recognized by its cinnamon color, separable membrane and the fimbriate margins with their conspicuous rhizomorphic strands. The coriaceous texture and character of the cystidia show similarity to *Steccherinum ochraceum* and have caused Bourdot and Galzin to consider these species as belonging to the genus *Mycoleptodon*. *O. fimbriata* is a typical *Odontia* except with respect to its coriaceous texture and this character alone does not seem to be a sufficient reason for placing it in another genus.

Common in Iowa. Collected from June to December on frondose species, particularly oak. This species is widely distributed in the United States and Canada.

5. ODONTIA CILIOLATA (Berk. & Curt.) Miller, Mycologia 26: 18. 1934. (Plate III, Figure 21)

Hydnum ciliolatum Berk. & Curt. Jour. Bot. & Kew Misc. 1: 235. 1849.

Effused, ceraceous, thin, adnate, slightly cracking in drying, light ochraceous-buff; margin not differentiated or rarely fibrillose;

teeth 0.7 mm. or less in length, slender, crowded, hispid, extending to the margin; hyphae 2-4.5 μ, thick-walled, with few septations, or thin-walled, with occasional clamp connections in the subhymenial layer; cystidia 35-60 × 5-12 μ, subclavate or subulate, obtuse, thick-walled, strongly incrusted; basidia clavate with 4 sterigmata; spores 4-5 × 2-3 μ, elliptical, smooth, hyaline.

Two specimens of *Hydnum ciliolatum* Berk & Curt. were examined at the New York Botanical Garden. One had been determined by Cooke and the other by Banker, who had compared the specimen with the type at Kew and had marked it "identical." Berkeley's original description indicates the accuracy of their determinations. These and the Iowa specimens seem closely related to *Odontia fimbriata*, and are practically indistinguishable when viewed microscopically. Macroscopically the present species differs in the adnate, ceraceous and lighter colored fructification, the relatively undifferentiated margin and in the more slender and longer teeth.

Two specimens from Iowa were collected in March and August on much decayed deciduous wood. Its occurrence is reported from several scattered localities in the eastern United States.

6. ODONTIA LAXA Miller, Mycologia 26:19. 1934. (Plate IV, Figure 22)

Extremely thin and fragile, loosely adnate, soft floccose, with a pruinose hymenial surface, white to pinkish buff; margin floccose or thin and appressed, sometimes fibrillose, slightly darker in color; teeth subulate to cylindrical, very slender, with prominent cystidia at the sides and the crests; hyphae of the subhymenial region and in the axial portions of the teeth 5-7 μ in diameter, uniform, thick-walled, septate, branching at wide angles, without clamp connections, hyaline or slightly yellowish and often incrusted, becoming more compact, smaller, hyaline, thin-walled and sometimes obscured by granular material in a thin hymenial layer; cystidia 40-75 × 5-10 μ, numerous, consisting of the cylindrical ends of the coarse hyphae present in the axial portion of the teeth, projecting, strongly incrusted; basidia 7-9 × 3-4- μ, indistinct; spores 3-3.5 × 1.75-2.25 μ, ellipsoid, attenuate, hyaline.

A specimen labeled *Hydnum fascicularia* Berk. & Curt., on elm, July 30, 1893, in the Morgan collection, now in the mycological herbarium of the State University of Iowa and presumably from

Ohio is identical with Iowa material. A portion of the Morgan specimen was compared with the type of *Hydnum fasciculatum* at Kew by Miss Wakefield who reported that they were certainly not the same species. Since the Morgan collection was considerably larger than his own Iowa collection, the senior author designated it as the type of *O. laxa.*

This species has cystidia similar to those of *Odontia fimbriata* and *O. ciliolata* but is readily distinguishable from them by the floccose texture, the large, uniform hyphae and the smaller spores.

Apparently rare in Iowa, having been collected but once on a fragment of bark near Wellman, Iowa, in October.

7. ODONTIA SUDANS (Fries) Bres. Accad. Sci. Lett. Rovereto III. 3:100. 1897. (Plate IV, Figure 23)

Hydnum Agardhii Fries, Syst. Myc. 1:418. 1821.
Hydnum sudans Alb. & Schw. ex Fries, Syst. Myc. 1:425. 1821.
Thelobolus sudans Fries, Elench. Fung. 2:51. 1828.
Grandinia Agardhii Fries, Epicr. 528. 1838.
Dacryobolus sudans Fries, Summa Veg. Scand. 404. 1849.
Porothelium Stevensoni Berk. & Br. Ann. Mag. Nat. Hist. V. 1:23. 1878.
Porothelium confusum Berk. & Br. Ann. Mag. Nat. Hist. V. 1:24. 1878.
Grandinia exsudans Karst. Medd. Soc. Faun. Fl. Fenn. 9:51. 1882.
Grandinia sudans Lloyd, Myc. Notes 52:741. 1917.

Effused, thin, membranaceous, separable in small pieces, warm buff to cinnamon-buff; margin similar, byssoid or pruinose, sometimes whitish; teeth short, scattered, conical or short cylindrical, terminated by a viscid and more or less transparent, cylindrical or tapering, and projecting fascicle of cystidia; hyphae 1-3 μ in diameter, walls somewhat thickened, septate, occasionally with clamp connections, agglutinated and projecting as a prominent fascicle; basidia 15-24 × 3-4 μ, cylindrical-clavate, with 4 sterigmata; spores 5-7 × 1-1.5 μ, cylindrical, curved, smooth, hyaline.

This species can usually be readily recognized by the fascicle of viscid and transparent cystidia which project prominently from the apices of the spines. This character is quite conspicuous when viewed under a lens. Their contraction in drying and their more or less transparent appearance have been the cause of several strik-

ing errors in the literature, as is evidenced by the rather extended synonymy. The teeth are often described as cupped or excavated, even by comparatively recent authors. Fries in his Systema Mycologicum described the species under the name *Hydnum Agardhii* and apparently regarded *H. sudans* Alb. & Schw. as representing a doubtful species.

Common in Iowa. Collected from June to November on wood of deciduous and coniferous species. In Europe this species is reported on coniferous wood only. Probably wide-spread in North America.

8. ODONTIA CRISTULATA Fries, Epicr. 529. 1838. (Plate IV, Figure 24)

Effused, thin, soft, subceraceous, slightly cracking and pruinose, adnate, white to cream color; margin whitish, floccose or pruinose; teeth subdistant, conical, short and fragile, fimbriate at the crest; hyphae 2.5-5 μ in diameter, loosely interwoven, dividing upward and becoming quite compact in the hymenium, with numerous clamp connections; cystidia only slightly differentiated, often irregular in shape, loosely fascicled at the apices of the teeth, with spherical clusters of crystals, with or without cross-walls; basidia 12-18 × 4-5 μ, clavate, with 2-4 sterigmata; spores 6-7 × 2-2.5 μ, cylindrical, flattened on one side, smooth, hyaline, often 1-2 guttulate.

Bresadola, and Bourdot and Galzin give the spore size as 8-10 × 3.5-4 μ. However, a specimen of *O. cristulata* Fries from Bourdot at the Farlow herbarium resembles the Iowa specimen in external appearance and seems to be identical in microscopic structure.

This species bears a close resemblance to *O. setigera* in macroscopic appearance but has less conspicuous cystidia and apparently smaller spores.

Collected once in Iowa on much decayed deciduous wood near North Liberty in November. Specimens have been collected in Ontario, Idaho and New York, indicating a wide range.

9. ODONTIA ALUTACEA (Fries) Bres. *sensu* Bourd. & Galzin. Hym. France 422. 1927. (Plate IV, Figure 25)

Hydnum alutaceum Fries, Syst. Myc. 1:417. 1821.
Kneiffia stenospora Karst. Hedwigia 25:231. 1886.

Effused, adnate, thin, loose and floccose, near cinnamon-buff; margin similar; teeth scattered or crowded, sometimes grouped,

conical, pointed or slightly fimbriate; hyphae 2.5-5 μ in diameter, thick-walled, clamp connections numerous; cystidia in terminal tufts and widely scattered along the sides, little differentiated, not incrusted, with or without cross-walls and clamp connections, obtuse; basidia 10-20 × 4-5 μ, with 4 sterigmata; spores 7-9 × 1.5-2 μ, cylindrical, curved, smooth, hyaline.

Bresadola (1897) and probably Quélet (1888) applied the name *Odontia alutacea* (Fries) to a form of *Odontia arguta* (Fries) Quél. Bourdot and Galzin (1927) based their conception of the species on a fragment of an authentic specimen of *Hydnum alutaceum* Fries from Romell. Our Iowa specimen agrees entirely with Bourdot and Galzin's description and with an authentic specimen of *Kneiffia stenospora* from Karsten at the New York Botanical Garden, which they cite as a synonym. Three specimens of *O. alutacea* received from Litschauer also agree closely with our Iowa collection. The floccose texture and the long, slightly curved, cylindrical spores characterize this species.

Apparently rare in Iowa, having been collected but once on oak in September, 1931. Two collections from the Kaniksu National Forest in Idaho, now in the University of Iowa Herbarium, a collection from Millinocket, Maine and one from Ontario indicate a wide range.

10. **Odontia albicans** (Pers.) comb. nov.

Hydnum granulosum var. *albicans* Pers. Myc. Eur. 2:184. 1825.

Odontia subalbicans [Pers.] Bres. Ann. Myc. 1:87. 1903.

Effused, floccose, with a thin subceraceous hymenium which is easily crumbled when dry, loosely adnate, light pinkish cinnamon to cinnamon-buff; margin similar or floccose, thinning out; spines short, pointed, apex fimbriate, subdistant to somewhat crowded; hyphae 2.5-6 μ in diameter, with numerous clamp connections, loosely arranged next to the substratum and compact in the hymenium; cystidia 4-6 μ in diameter, little differentiated, axial or terminal, fascicled, projecting, septate and with clamp connections; basidia 18-35 × 5-7 μ, clavate, with 2-4 sterigmata; spores 7-10 × 3-4 μ, cylindrical, slightly curved, smooth, hyaline, granular or guttulate.

This species is recognized by its relatively large cylindrical spores and by the slender fascicled cystidia projecting prominently at the apices of the teeth. Bourdot and Galzin give the spore size as 7-8.5 ×

2.75-3 μ. The measurements given here, while larger, are in accord with Bresadola's description. His name is based on Persoon's varietal name published in 1801, invalid because it was superceded by the same author's varietal name of 1825. An authentic specimen from Bresadola, studied at the New York Botanical Garden, agrees with our Iowa specimens.

Uncommon in Iowa. Collected twice in August on much decayed oak wood near McGregor, and once in October, 1941, near North Liberty, on much decayed oak wood. While undoubtedly occurring elsewhere in the United States, it does not seem to be reported.

11. ODONTIA CRUSTOSA (Fries) Quél. Fl. Myc. France 436. 1888. (Plate IV, Figure 27)

Hydnum crustosum Pers. ex Fries, Syst. Myc. 1:419. 1821.
Grandinia crustosa Fries, Epicr. 528. 1838.

Effused, often orbicular, ceraceous-crustaceous, usually cracking in drying, pinkish buff to cinnamon-buff, sometimes more yellowish; margin pruinose or narrowly floccose, white; teeth small, scattered to subdistant, subulate to short cylindrical, obtuse, sometimes weakly divided into several processes each of which is terminated by a slight projecting bundle of sterile hyphae; hyphae 2-4 μ, with clamp connections, 3-5 μ at the apex of the teeth; cystidia fusiform or subulate, few to numerous in the hymenium, barely emerging, of the same diameter as the basidia, thin-walled; basidia 15-30 × 4-6 μ, with 4 sterigmata; spores 6-8 × 3-4 μ, subcylindrical, smooth, hyaline, occasionally 1-guttulate.

The subulate, hymenial cystidia are differentiated chiefly by their shape and might well be regarded as paraphyses. This species seems to approach *O. cristulata* but is separated from it by the subulate hyphal structures and the slightly thicker spores.

Common in Iowa. Collected from April to December on deciduous wood. Reported frequently from North America, but many of the specimens determined as this species prove, upon examination, to represent other species.

12. ODONTIA BICOLOR (Fries) Bres. Ann. Myc. 1:87. 1903. (Plate IV, Figure 28)

Hydnum bicolor Alb. & Schw. ex Fries, Syst. Myc. 1:417. 1821.
Hydnum subtile Fries, Syst. Myc. 1:425. 1821.
Odontia subtilis Quél. Fl. Myc. France 435. 1888.

Hydnum serratum Peck, Ann. Rep. N. Y. State Mus. 50:112. 1897.
Hydnum echinosporum Vel České houby 745. 1922.

Widely effused, thin, adnate, soft, pruinose, becoming ceraceous in older portions, cracking slightly in the ceraceous portions, cartridge buff when fresh; margin pruinose, indeterminate, often quite wide, concolor or white; teeth up to 0.3 mm. in length, short, fragile, more or less regular in shape, obtuse or divided into several points, scattered evenly, more crowded in the older portions, crests, when pointed, usually composed of sterile hyphal ends; hyphae 2-3μ in diameter, thin, collapsed and loosely agglutinated which somewhat obscures the hyphal characters, no clamp connections seen; cystidia of two kinds, 6-18μ in diameter, terminating in a globose enlargement which sometimes contains a yellowish material, or covered with radiating crystals, submerged or projecting; basidia 10-20 × 3-5μ, clavate, with 4 sterigmata; spores 4.5-6 × 2.5-3μ, oblong, obliquely attenuate, smooth, hyaline.

This species is readily recognized by its characteristic cystidia. The enlarged terminations of the smooth cystidia in many cases are collapsed and apparently empty. These differ from the cystidia in which the enlarged ends are covered with crystals in that they are fewer in number or absent and arise from hyphae of greater diameter.

This species has been collected once in Iowa on a prostrate log in April. It is probably quite common as it is widely distributed in North America.

13. ODONTIA ARGUTA (Fries) Quél. Fl. Myc. France 435. 1888.
(Plate V, Figure 29)

Hydnum argutum Fries, Syst. Myc. 1:424. 1821.
Odontia alutacea Bres. Atti Accad. Rovereto III. 3:97. 1897.

Effused, thin, soft, floccose, arachnoid to pubescent, pruinose when dry, usually slightly cracking in drying, cartridge buff to cinnamon-buff; margin similar, thinning out or floccose; teeth 1-2 mm. in length, variable, at first short, then cylindrical or subulate, pointed, divided or penicillate at the apex, finely pubescent; hyphae 2-4μ in diameter, distinct, with clamp connections, occasionally slightly incrusted; cystidia mostly 20-30 × 3-4μ, fusiform or subu-

late, with incrusted terminations, projecting from the hymenium, sometimes accompanied by others which are 4-6μ in diameter, cylindrical, with obtuse or slightly enlarged, smooth or incrusted terminations up to 9μ in diameter; basidia 10-16 × 4-5μ, clavate, with 4 sterigmata; spores 5-6 × 4-5μ, obovate, smooth, white, sometimes 1-guttulate.

This species resembles *Odontia spathulata* (Fries) Litsch., but can readily be distinguished by the variable but characteristic cystidia, the more floccose texture and the pubescent appearance of the surface of the fructification. The hymenial cystidia with their incrusted terminals separate it from other related species of *Odontia*. The fructifications are often so thin as to appear arachnoid under the lens.

O. arguta is one of the most abundant species of Hydnaceae in Iowa and is collected on old wood of deciduous and coniferous species throughout the year. Widely distributed in North America.

14. ODONTIA LIVIDA Bres. Nuovo Giorn. Bot. Ital. 23:158. 1891.

(Plate V, Figure 30)

Widely effused, thin, thicker with age, sometimes cracking in drying, ceraceous-crustaceous, typically honey-yellow but varying from chamois to clay color; margin indeterminate or whitish, fimbriate; teeth deformed, short, rigid, hispid at the apex; hyphae 2-6 μ in diameter, without clamp connections; cystidia 4-8 μ in diameter, cylindrical, elongated, usually strongly incrusted and occurring in compact, branching fascicles which project 25-250 μ at the apex of the teeth; basidia 18-32 × 5-7 μ, clavate; spores 5-7 × 3.5-4.5 μ, elliptical, smooth, with granular content, sometimes 1-guttulate, faintly yellow in mass.

This species is characterized by its large, granular spores and strongly incrusted, fascicled cystidia which project prominently from the apices of the teeth. The senior author studied an authentic specimen from Bresadola at the New York Botanical Garden, and found it to be identical with Iowa specimens. The descriptions of *Odontia corrugata* (Fries) Bourd. & Galz. and *Odontia junquillea* Quél. indicate fungi similar to this species.

Fairly common in Iowa. Collected from April to August on decaying deciduous wood. Widely distributed in North America.

15. ODONTIA CRUSTULA Miller, Mycologia 26:29. 1934.
(Plate V, Figure 31)

Widely effused, extremely thin, crustaceous-ceraceous, adnate, slightly cracking, white to cream buff; margin indeterminate, pruinose or minutely and narrowly floccose, sometimes slightly fimbriate, white; spines short, conical to short cylindrical, very obtuse, usually with the crests divided into whitish processes; hyphae 2.5-5μ in diameter, thin-walled, clamp connections present, incrusted in the axial portion of the teeth; cystidia 4-6μ in diameter, cylindrical, in strongly incrusted, more or less agglutinated bundles, projecting 15-100μ at the apex of the teeth; basidia 15-25 × 4.5-7μ, clavate; spores 4-6 × 3-3.5μ, ellipsoid, smooth, hyaline or granular, sometimes guttulate.

This species is ceraceous and is characterized by one or more bundles of incrusted and relatively unspecialized cystidia at the crest of the teeth. The senior author was unable to assign this specimen to any known species and Litschauer reported that he knew of no European species to which it might be referred.

Rather common in Iowa. Type specimen collected near Milford, Iowa, on linden, June 16, 1931, and deposited in the mycological herbarium at the State University of Iowa. Collected from June to October on decorticated wood and bark of deciduous and coniferous species.

16. ODONTIA FUSCO-ATRA (Fries) Bres. Atti Accad. Rovereto III. 3:95. 1897.
(Plate V, Figure 32)

Hydnum fusco-atrum Fries, Syst. Myc. 1:416. 1821.
Hydnum carbonarium Peck, Ann. Rep. N. Y. State Mus. 40:55. 1887.
Odontia membranacea (Fries) Bres. Atti Accad. Rovereto III. 3:95. 1897.
Acia fusco-atra (Fries) Pat. Tax. Hymén. 69. 1900.
Acia membranacea (Fries) Bourd. & Galz. Bull. Soc. Myc. France. 30:258. 1914.
Mycoacia fusco-atra (Fries) Donk, Med. Ned. Myc. Ver. 18-20:152. 1931.

Effused, soft, ceraceous, usually cracking in drying, adherent, color variable, dark-gray or fawn color to burnt umber when fresh,

cinnamon-buff to fuscous-black in the herbarium; margin pruinose or radially fibrillose, usually lighter in color, sometimes not differentiated; teeth 0.5-2 mm. in length, stout, subulate, mostly entire and pointed or slightly divided at the crest, sometimes ciliate, often remaining pale at the apices; hyphae 3-4μ in diameter, distinct, with clamp connections, parallel and compact in the teeth, incrusted, single or in fascicles in the axial portion, crystals minute; cystidia 4-5μ in diameter, cylindrical, incrusted, elongate, arising from the axial portion of the teeth, sometimes a few inconspicuous, thin-walled, subulate, hymenial cystidia are also present; basidia 15-25 × 3-5μ; spores 4.5-6 × 2-3μ, short cylindrical, barely depressed on one side, smooth, hyaline.

Odontia fusco-atra bears a slight resemblance to *O. uda* but is usually quite easily separated from it by its darker colored fructification, larger, more distinct hyphae with more clamp connections, the stouter, more crowded teeth and the less fascicled hyphae and cystidia.

This species varies considerably in color. The lighter forms tend to have a more distinct margin and are colored slightly by a KOH solution. *Hydnum carbonarium* Peck is based on such forms. A specimen of *Odontia membranacea* (Fries) from Bresadola and another from Galzin in France, studied at the New York Botanical Garden, seem to be identical with light forms which are here regarded as *O. fusco-atra*. Although Bresadola maintained that *O. membranacea* differed from *O. fusco-atra* in the more slender and crowded teeth and in the slight differences in the color of the initial growth, the senior author interpreted these to be due to growth variations only and pointed out that the two forms are identical in microscopic characters.

O. fusco-atra is quite common in Iowa from March to late in November and is found on wood of various frondose species. Widely distributed in North America.

17. ODONTIA UDA (Fries) Bres. Atti Accad. Rovereto III. 3:97. 1897.

(Plate V, Figure 33)

Hydnum udum Fries, Syst. Myc. 1:422. 1821.
Acia uda Bourd. & Galz. Bull. Soc. Myc. France 30:255. 1914.
Mycoacia uda (Fr.) Donk; Med. Ned. Myc. Ver. 18-20:151. 1931.

Effused, soft ceraceous, usually slightly cracking in drying, adherent, mustard yellow to chamois or tawny; margin radially fibrillose or pruinose, occasionally similar but usually lighter, sometimes subhyaline; teeth scattered to crowded, slender, subulate, entire or fimbriate and divided at the crest, apices often white upon drying; hyphae 2-4μ, thin walled, compact, incrusted in the axial portion of the tooth, clamp connections rare; cystidia 2-5μ in diameter, cylindrical, only slightly differentiated, usually emerging in incrusted fascicles; basidia 15-25 × 3.5-5μ, clavate, with 4 sterigmata; spores 4.5-6 × 2-3.5μ, ellipsoid, slightly depressed on one side, smooth, granular or hyaline.

The fructification turns purple upon contact with a KOH solution, making this, at times, a useful taxonomic character. Iowa specimens agree closely with European material determined by Bourdot, Bresadola and Litschauer.

Fairly common in Iowa from March to October on wood of frondose species. Quite widely distributed in the Eastern and Central states.

18. ODONTIA BARBA-JOVIS Fries, Epicr. 528. 1838.
(Plate V, Figure 34)

Hydnum Barba-Jovis With. ex Fries, Syst. Myc. 1:421. 1821.
Hydnum Nyssa Berk. & Curt. Grevillea 1:100. 1873.
Kneiffia irpicoides Karst. Bidr. Finl. Nat. Folk 48:368. 1889.

Widely effused, soft, floccose, loosely adnate, whitish to pinkish buff; margin indeterminate; teeth variable in size, not exceeding 4 mm. in length, soft, subdistant to crowded, slender, terete or subulate, fimbriate or terminated by one or more tapering tufts of cystidia, also bristly on the sides; hyphae 2-4μ in diameter, thin-walled or thickened, with clamp connections; cystidia greatly elongated, 2-10μ in diameter, cylindrical, thick-walled, becoming thin-walled and sometimes incrusted near the outer extremities, projecting in tufts at the apices of the teeth and singly along the sides; basidia 15-25 × 3-6μ; spores 4-7 × 2.5-4.5μ, oblong, smooth, hyaline, often 1-guttulate.

This species, while approaching *Odontia stipata* in its soft, floccose, loosely adnate fructification, differs quite markedly in its thicker and more prominent cystidia and the larger, coarser teeth.

The senior author studied a number of specimens determined as *O. Barba-Jovis* by Bourdot and Bresadola at the New York Botan-

ical Garden and found them to agree closely with two Iowa specimens. An authentic specimen of *Kneiffia irpicoides* Karsten and a fragment of the type of *Hydnum Nyssa* Berk. and Curt. at the New York Botanical Garden also were examined and clearly represent the same species.

Rather uncommon in Iowa. Collected on decaying deciduous wood near Wellman and North Liberty in August and October. Specimens have also been collected in Maryland, New York and Louisiana.

19. ODONTIA STIPATA (Fries) Quél. Fl. Myc. France 435. 1888.
(Plate VI, Figure 35)

Hydnum stipatum Fries, Syst. Myc. 1:425. 1821.

Effused, thin, soft, floccose, loosely adnate, whitish, becoming light buff; margin white, tomentose, sterile; teeth slender, entire or divided, pointed or sometimes slightly fimbriate, unequal in length; hyphae 2-3.5μ, thin-walled, with clamp connections; cystidia 2.5-4μ in diameter, emerging in terminal tufts, not strongly differentiated; basidia 12-20 × 3-5μ, clavate to cylindrical, with 4 sterigmata; spores 4-6 × 3-4μ, oblong, smooth, hyaline.

Odontia stipata is characterized by the extremely soft, floccose texture of the fructification, the slender pointed teeth which are unequal in length, and the emerging tufts of cystidia. Iowa material closely resembles European specimens as determined by Bourdot, Bresadola and Litschauer.

Uncommon in Iowa. Collected once on a decorticated elm log near Wellman, in October, and once at Estherville in July. Reported from the eastern United States. Collected also in Ontario. The Iowa specimen referred to *O. stipata* by Cejp (1931) is *Odontia spathulata* (Fries) Litschauer as here understood.

20. ODONTIA SPATHULATA (Fries) Litsch. Öesterr. Bot. Zeit. 88:125. 1939.
(Plate VI, Figure 36)

Hydnum spathulatum Schrad. ex Fries, Syst. Myc. 1:423. 1821.

Irpex spathulatus Fries, Elench. Fung. 1:146. 1828.

Radulum spathulatum (Fries) Bres. Ann. Myc. 1:89. 1903.

Effused, thin, soft, ceraceous or sometimes with a sub-ceraceous

hymenial layer and floccose next to the substratum, often cracking in drying, cartridge buff to light ochraceous-buff; margin similar, sometimes floccose and white; teeth 1.5 mm. or less in length, variable, subulate to cylindrical or spathulate to irpiciform, obtuse or pointed and fimbriate, often with pointed processes projecting from the sides and crests; hyphae 2-3 μ in diameter, with clamp connections, occasionally incrusted; cystidia not distinct, largely undifferentiated hyphae projecting from the hymenium or in bundles from the side and crest of the teeth, sometimes incrusted; basidia 12-16 × 3.5-5 μ, clavate, with 2-4 sterigmata; spores 4-6 × 2.5-4 μ, subspherical to elliptical, smooth, hyaline, sometimes 1-guttulate.

This species is quite variable and lacks distinct diagnostic characters. It resembles *Odontia arguta* and is considered a form of that species by Miss Wakefield. However, the smoother and more compact, ceraceous fructification and the absence of the conspicuous, incrusted cystidia, seem clearly to separate the two forms.

Common in Iowa from early June to October, on wood of frondose and coniferous species. Collected throughout the year. Apparently widely distributed in the United States.

VI. MYCOACIA Donk, Med. Ned. Myc. Ver. 18-20:150. 1931, emend. *Acia* Karsten, Medd. Soc. Faun. Fl. Fenn. 5:28. 1879; *Oxydontia* Miller, Mycologia 25:294. 1933.

Type Species: ***Hydnum setosum*** Pers.

Fructification resupinate, effused, adnate or separable, floccose, fleshy or ceraceous; spines typically long, subulate; cystidia absent; spores variable. Growing on wood.

Donk proposed *Mycoacia* for resupinate hydnaceous forms of waxy texture, including some cystidiate species. These latter, we feel, are better referred to *Odontia*, leaving in *Mycoacia* the non-cystidiate species formerly referred to *Oxydontia*. *Mycoacia* is separated from *Odontia* by its lack of cystidia and from *Grandinia* by the longer, subulate and conspicuous teeth. These distinctions are admittedly artificial but have the advantage of being convenient and fairly distinct. Since all gradations occur between sterile basidia and typical cystidia, certain species will obviously need to be placed arbitrarily in *Odontia* or in *Mycoacia*. The same is true of species possessing teeth intermediate between the typical dome-shaped or fragile warts of *Grandinia* and the elongated, subulate teeth of *Mycoacia*.

Mycoacia is essentially synonymous with *Acia* Karsten (1881) but this name is not tenable since *Acia* was applied to a genus of the Rosaceae by Schreber in 1791. *Mycoacia,* as here defined, includes a greater range of species than the *Acia* of Rea, and of Bourdot and Galzin. Forms that have floccose or fleshy as well as separable fructifications are added. *M. fragilissima* (Berk. & Curt.), for example, is ceraceous and a good "*Acia*" except that it is separable: *M. Himantia* (Schw.) or *M. alboviride* (Morg.) may have waxy *Acia*-like teeth but a floccose subiculum.

KEY TO THE SPECIES OF MYCOACIA

a. Fructification separable; hymenium light buff when fresh; gloeocystidia present; spores subspherical, about 5 × 4 μ---- 1. *M. macrodon*

a. Fructification separable or adnate; hymenium darker than light buff; gloeocystidia lacking; spores elliptical to subcylindrical ---- b

b. Fructification strongly adnate; context compact throughout; mycelial strands absent ---- c

b. Fructification separable or with a loose, floccose layer next to the substratum; margin usually with mycelial strands running over the substratum ---- d

c. Fructification bright yellow in color, with a strong odor when fresh; spores 5-6 × 3-4.5 μ; largely restricted to pomaceous hosts ---- 2. *M. setosa*

c. Fructification mars yellow to mars brown; odor not pronounced; spores 3-5 × 1.5-2.5 μ; on wood of various species ---- 3. *M. stenodon*

d. Fructification separable, bright orange in color; spores 3.5-4.5 × 2-2.5 μ ---- 4. *M. fragilissima*

d. Fructification adnexed to the substratum by a loose, white floccose layer, hymenium white to dark olive-buff or avellaneous; spores 7-12 × 3.5-5 μ ---- e

e. Hymenium dark olive-buff; hyphae smooth; spores roughened, dark olive-buff, 7-10 × 3-4 μ ---- 5. *M. alboviride*

e. Hymenium avellaneous; hyphae often faintly roughened; spores smooth, hyaline, 10-12 × 3.5-4.5 μ ---- 6. *M. Himantia*

1. **Mycoacia macrodon** (Fries) *comb. nov.*

(Plate VI, Figure 37)

Hydnum macrodon Pers. ex Fries, Syst. Myc. 1:415. 1821.

Hydnum fragile Pers. ex Fries, Syst. Myc. 1:418. 1821. (*non* Fries. 1874)

Dryodon mucidum Quél. Fl. Myc. France 438. 1888.

Hydnum separans Peck, Ann. Rep. N. Y. State Mus. 50:112. 1897.
Odontia macrodon (Fries) Bourd. & Galz. Bull. Soc. Myc. France 30:264. 1914.
Oxydontia macrodon (Fries) Miller, Mycologia 25:294. 1933.
Odontia separans (Peck) Brown, Bot. Gaz. 96:663. 1935.

Fructification resupinate, widely effused, soft, subceraceous when fresh, becoming farinaceous, membranaceous, separable and often becoming detached in drying, light buff when fresh; margin narrow, white, similar or byssoid; spines 5-10 mm. or less in length, 0.2-0.3 mm. in diameter, extremely slender, subulate or terete, crowded, often coalescing, scattered near the margin, curling slightly in drying, sterile at the apices; hyphae 2-4 μ, distinct, with numerous clamp connections, guttulate; gloeocystidia cylindrical to fusiform, with elongate, subulate, projecting tips, occasionally obtuse, slightly tortuous, 40-100 × 5-9 μ; basidia 20-30 × 4-6 μ, clavate, guttulate, with 2-4 sterigmata; spores 4-6 × 3-5 μ, subspherical, smooth, hyaline, 1-guttulate.

This species may be recognized by the soft, subceraceous fructification, the long slender spines, the gloeocystidia and the subspherical spores. It has been reported from this country under a variety of different names. A number of specimens observed at the New York Botanical Garden and in other herbaria which had been collected from widely scattered points in the eastern United States, were found to have been variously determined. The type of *Hydnum separans* Peck seems to possess the characters of a typical specimen of *O. macrodon*. This species has occasionally been referred to *Hydnum mucidum* Pers. The type of the latter species, however, represents an entirely different fungus according to Bresadola (1897), Donk (1931) and Bourdot (1932). *Hydnum fragile* Fries (1874) is applied to a stipitate form.

Fairly common in Iowa. Occurring on much decayed wood of frondose species from October to December.

2. MYCOACIA SETOSA (Pers.) Donk, Med. Ned. Myc. Ver. 18-20:152. 1931.

(Plate VI, Figure 38)

Hydnum setosum Pers. Myc. Europ. 2:213. 1825.
Hydnum luteocarneum Secr. Mycogr. Suisse 2:528. 1833.

Hydnum Schiedermayeri Heufl. Oest. Bot. Zeitschr. 20:33. 1870.
Dryodon setosum (Pers.) Pat. Hymén. Europ. 146. 1887.
Dryodon luteocarneum (Secr.) Quél. Fl. Myc. France 437. 1888.
Hydnum Earleanum Sumst. Torreya 4:59. 1904.
Hericium croceum (Schw.) Banker, Mem. Torrey Club 12:121. 1906.
Manina Schiedermayeri (Heufl.) Banker, Mycologia 4:277. 1913.
Hydnum foetidum Vel. České houby 744. (fide Cejp). 1922.
Acia setosa (Pers.) Bourd. & Galz. Hymen. France 418. 1928.
Oxydontia setosa (Pers.) Miller, Mycologia 25:366. 1933.

Fructification resupinate, becoming widely effused, ceraceous, adnate, thick, sometimes with tuberculous nodules from which curved teeth arise, giving off a strong odor resembling bitter almonds when fresh, primuline yellow, becoming dark with age; margin radially and coarsely fibrillose; spines 4-10 mm. in length, slender, terete, subulate, often swollen and somewhat pubescent at base, fascicled on the nodules or arising singly, colored similarly to the context or with reddish tips; hyphae 2-5 μ in diameter, thin-walled, with occasional clamp connections, compactly arranged, horizontal next to the substratum; basidia 15-25 × 4-6 μ, with 4 sterigmata; spores 5-6 × 3-4.5 μ, obovate, smooth, hyaline, uniguttulate.

The bright yellow color, the strong pungent odor, the nodulose subiculum, the small obovate, 1-guttulate spores and the largely restricted habitat on pomaceous wood clearly marks this species from other hydnums.

In the United States this species commonly goes under the name *Hydnum Schiedermayeri*. Common in Iowa on the dead trunks and limbs of *Malus* and *Crataegus* from May to December. Donk reports that this fungus is probably a parasite on apple and pear trees in Europe. Widely reported throughout the central and eastern United States.

3. MYCOACIA STENODON (Pers.) Donk, Med. Ned. Myc. Ver. 18-20:151. 1931. (Plate VI, Figure 39)

Hydnum stenodon Pers. Myc. Europ. 2:188. 1825.
Odontia stenodon (Pers.) Bres. Atti Accad. Rovereto III. 3:96. 1897.

Acia stenodon (Pers.) Bourd. & Galz. Bull. Soc. Myc. France 30: 256. 1914.
Hydnum mucidum Vel. České houby 744. 1922. (fide Cejp).
Oxydontia stenodon (Pers.) Miller, Mycologia 25: 367. 1933.

Fructification effused, fleshy-ceraceous, adnate, cracking when drying, mars yellow in younger portions to mars brown in older parts; margin lighter in color, fibrillose; spines 1-2 mm. or less in length, slender, mostly entire, sometimes fimbriate, crowded and more or less connate at the base; hyphae 2-3 μ in diameter, thin-walled, compact and somewhat coalesced; basidia 10-15 × 3-4 μ, clavate; spores 3-4.5 × 1.5-2 μ, elliptical, depressed on one side to distinctly curved, smooth, hyaline.

This species resembles *Odontia uda* and *Odontia fusco-atra* but has smaller spores than either, does not possess the incrusted axial and often emergent hyphae of the spines and may be distinguished by the reddish and more fleshy subiculum. It does not turn purple in a potassium hydroxide solution.

Uncommon in Iowa; collected but twice, in August, 1931, and November, 1940, on decaying deciduous wood. Reported from New York and Michigan.

4. **Mycoacia fragilissima** (Berk. & Curt.) *comb. nov.* (Plate VI, Figure 40)

Hydnum fragilissimum Berk. & Curt. Grevillea 1: 100. 1873.
Hydnum ischnodes Berk. Grevillea 1: 101. 1873. *non* Morgan.
Hydnum chrysocomum Underw. Bull. Torrey Club. 24: 82. 1897.
Acia chrysocoma (Underw.) Pat. Tax. Hymén. 69. 1900.
Odontia crocea Lloyd, Letter 53: 11. 1914.
Oxydontia fragilissima (Berk. & Curt.) Miller, Mycologia 25: 364. 1933.

Fructification effused, fleshy-membranaceous when fresh, papery-membranaceous when dry, often becoming partially detached, yellow to chrome orange when fresh; margin white at first but often becoming yellowish, fibrillose and with long, orange colored, rhizomorphic strands running loosely over the substratum; teeth 1-4 mm. in length, slender, terete or subulate, occasionally confluent and flattened, subdistant to crowded, sometimes terminated by sterile hyphae; hyphae 4-7 μ in diameter, thick-walled, sometimes incrusted with fine, orange-colored granules, septate, with rare

clamp connections in the strands and loosely interwoven mycelium next to the substratum; 2-4 μ in diameter, thin-walled, in more compact spines and subhymenial region, septate, without clamp connections; basidia 15-25 × 4-6 μ with 2-4 sterigmata; spores 3.5-4.5 × 2-2.5 μ, ellipsoid, smooth, hyaline.

This species is recognized by its bright orange fructification and the long, mycelial strands of the same color. Its growth is restricted to the lower side of much decayed limbs or bits of wood, particularly those that are partially submerged in the forest humus. The wood immediately above the fructification is often colored red. The original description of *H. fragilissimum* fits this species except as to color. Since the orange usually fades in the herbarium, the "white" color mentioned by Berkeley is readily explained.

After examining the types of *Hydnum ischnodes* Berk., *Hydnum chrysocomum* Underw. and an authentic specimen of *Odontia crocea* Lloyd, the senior author reports them all to be the same species. Lloyd applies Schweinitz's specific name *croceum* to this species merely on the basis of the original meager description, after having made the earlier comment (Letter 42:4), concerning the same species, "there is nothing in Schweinitz's short 'description' to give any clue even to its identity."

Common in Iowa on decayed wood of frondose species. Collected from June to January. Apparently quite widely distributed in the south central and eastern United States.

5. **Mycoacia alboviride** (Morg.) *comb. nov.* (Plate VI, Figure 41)

Hydnum alboviride Morg. Jour. Cinc. Soc. Nat. Hist. 10:12. 1887.

Oxydontia alboviride (Morg.) Miller, Mycologia 25:294. 1933.

Fructification widely effused, 600-800 μ in thickness, consisting of a loose, floccose, white subiculum which is usually not covered by a hymenium; margin similar or rhizomorphic; spines 2 mm. in length, terete, subulate, pointed, usually sterile at the apices, at first white, then dark olive-buff, usually curling in drying; hyphae 1.5-5 μ in diameter, loosely interwoven in the subiculum, with numerous clamp connections, smooth; basidia 20-30 × 3.5-5 μ, clavate, with 4 sterigmata; spores 7-10 × 3-4 μ, fusiform, attenuated and slightly curved at one end, roughened, dark olive-buff.

This species is readily recognized by its loose, floccose subiculum

and the dark olive-buff, roughened spores. It has often been confused with *Hydnum Himantia* Schw. from which it may be separated by the smooth hyphae and the colored, roughened spores.

A number of specimens of this species have been examined at the New York Botanical Garden from Massachusetts, Indiana, Connecticut, and New York. In the University of Iowa collection there are specimens from Michigan and Ohio, including an authentic specimen collected by Morgan in 1888 which undoubtedly represents the true *Hydnum alboviride* Morg.

Three specimens have been collected in Iowa from early April to October. Apparently widely distributed in the United States and Canada.

6. **Mycoacia Himantia** (Schw.) *comb. nov.* (Plate VI, Figure 42)

Hydnum Himantia Schw. Schr. Nat. Gez. Leipzig 1:104. 1822.
Hydnum subfuscum Peck. Ann. Rep. N.Y. State Mus. 40:55. 1887.
Odontia Himantia (Schw.) Bres. Ann. Myc. 1:85. 1903.
Coniophora flavomarginata Burt, Mo. Bot. Gard. Ann. 13:311. 1926.
Clavaria Himantia (Schw.) Bourd. & Galz., Hym. France 122. 1928.
Oxydontia Himantia (Schw.) Miller. Mycologia 25:363. 1933.

Fructification resupinate, widely effused, consisting of a waxy, pelliculose hymenial layer which is avellaneous in color and 50-200 μ in thickness, and a loose, floccose, white layer next to the substratum, 200-1000 μ in thickness, sometimes with large areas of white, cottony mycelium not covered by the hymenium; margin floccose or fibrillose and with white, rhizomorphic strands running over the substratum; spines 6 mm. or less in length, terete, obtuse, or sometimes subulate, pointed, often curling slightly in drying; hyphae 2-4 μ in diameter, faintly roughened, with numerous clamp connections, often swollen at the septa, with scattered masses of crystalline material; basidia 25-40 × 6-8.5 μ, with 2-4 long sterigmata; spores 10-12 × 3.5-4.5 μ, cylindrical-ellipsoid, attenuate at one end, smooth, granular or guttulate, hyaline.

The loose, floccose subiculum covered in places by a waxy pelliculose layer, the rhizomorphic strands, the roughened hyphae often swollen at the septa and the large spores are diagnostic char-

acters for this species. The hymenium of a young fructification may be confined entirely to the spines, in which case the white cottony subiculum gives the specimen the aspect of *Mycoacia alboviride*. These two species have been confused in this country. They can be separated readily, however, by the color of the hymenium and the spore and hyphal characters. *Mycoacia alboviride* has dark olive-buff, roughened spores and smooth hyphae.

Common in Iowa. This species occurs on much decayed wood from April to December and is apparently an active wood rotting form. One luxuriant growth was observed covering the lower side of a fallen limb for an estimated distance of twenty feet. Widely distributed in the United States.

VII. STECCHERINUM S. F. Gray, Nat. Arr. Brit. Pl. 1:651. 1821; *Pleurodon* Quélet, in Cooke and Quélet, Clav. Hymen. 198. 1878, in part; *Creolophus* Karsten, Medd. Soc. Faun. Fl. Fenn. 5:27. 1879; *Climacodon* Karsten, Rev. Myc. 3:20. 1881; *Leptodon* Quélet, Ench. Fung. 191. 1886, emend. Pat. Hymén. Europe. 145. 1887; *Mycoleptodon* Pat. Tax. Hymén. 116. 1900.

Type species: ***Hydnum ochraceum*** Pers.

Pileus laterally substipitate or sessile, reflexed or rarely entirely resupinate, usually tough and fibrous, sometimes subfleshy; spines terete or flattened; cystidia common; spores minute, smooth, ovoid to oblong, white in mass. Growing on wood.

Steccherinum is related to *Gloiodon* and to *Auriscalpium*, but may be separated readily from the former by the hyaline hyphae, smooth spores and the absence of the solid processes ramifying through the pileus, and from the latter by a generally lighter colored fructification and the absence of a distinct stipe.

Several attempts have been made to divide the species represented in *Steccherinum* into more homogeneous groups. Karsten proposed the name *Creolophus* apparently to include the subfleshy species and *Climacodon* the leathery members but the distinction was not clearly made. Banker suggested a similar division in 1913. Such a distinction between fleshy and leathery members of the genus seems inadvisable, however, since all, including *S. pulcherrimum*, which is perhaps regarded as the most "fleshy," have a more or less fibrous texture.

KEY TO THE SPECIES OF STECCHERINUM

a. Usually resupinate, sometimes reflexed or rarely distinctly pileate; with numerous, strongly incrusted, elongate and emerging, cylindrical or clavate cystidia ---------- b
a. Distinctly pileate or rarely reflexed; cystidia, if present, short, fusiform and relatively few in number ---------- d
b. Resupinate, sodden and corky-fibrous when fresh, hard and brittle when dry, curling; spines often crowded and coalesced at the base; spores 6-7 × 3-4 μ ---------- 1. *S. setulosum*
b. Resupinate, reflexed or rarely entirely pileate, dry, soft, leathery; spines usually separate; spores 3-5.5 × 2-3.5 μ ---------- c
c. Margin of fructification usually reflexed to distinctly pileate; spines terete or angular, occasionally flattened, usually quite uniform in shape and size; seldom darker than vinaceous cinnamon; spores 3-4 × 2-2.5 μ ---------- 2. *S. ochraceum*
c. Resupinate to slightly reflexed; margin radially and irregularly fimbriate; spines terete or greatly flattened, often serrate, irregular in size; more orange than vinaceous cinnamon; spores 4-5.5 × 3-3.5 μ ---------- 3. *S. laeticolor*
d. Spines 6-18 mm. in length; cystidia short, fusiform; spores 4-6 × 2.5-3.5 μ ---------- 4. *S. septentrionale*
d. Spines 1-5 mm. in length, cystidia fusiform or absent; spores 5 μ or less in length ---------- e
e. Texture soft, fibrous-fleshy; cystidia absent; hyphae with 2 prominent clamp connections at many septa; spores 4-5 × 2-2.5 μ ---------- 5. *S. pulcherrimum*
e. Texture leathery, fibrous; cystidia present or absent; clamp connections single or absent; spores 4 μ or less in length ---------- f
f. Often with a short lateral stipe, occasionally eccentric or mesopodous, with abortive or fully developed pilei arising from upper surface of lower ones; faintly zoned near the margin only; spores short cylindrical, 2.5-3 × 1-1.25 μ -- 6. *S. adustum*
f. Stipe lacking or represented by a restricted base; distinctly zonate; spores ovoid to ellipsoid ---------- g
g. Cystidia fusiform; spores ellipsoid, 3-4 × 2 μ ---------- 7. *S. rawakense*
g. Cystidia absent; spores ovoid, 2-2.5 × 1.5 μ ---------- 8. *S. pusillum*

1. STECCHERINUM SETULOSUM (Berk. & Curt.) Miller, Mycologia 27: 362. 1935. (Plate 7, Figure 43)

Hydnum setulosum Berk. & Curt. Grevillea 1: 100. 1873.

Resupinate, effused, adnate, thick, soft corky-fibrous, waterlogged when fresh, contracting and curling upon drying but not cracking, becoming hard and brittle; color avellaneous when fresh, becoming cinnamon to army brown in the herbarium; margin concolor; spines 2-9 mm. in length, variable, usually crowded and more

or less coalesced at the base, terete, cylindrical and obtuse to subulate and acute, sometimes flattened and branched; hyphae 1.5-4 μ in diameter, thin-walled, with scattered clamp connections, others thick-walled, compactly arranged in older fructifications; cystidia 30-90 × 4-10 μ, numerous, long, cylindrical to clavate, obtuse, incrusted, arising from the thick-walled hyphae in the axial portion of the spine and in the subiculum, projecting; basidia 20-25 × 6-7 μ, clavate, with 4 sterigmata; spores 6-7 × 3-4 μ, ellipsoid, smooth, granular or guttulate.

S. setulosum is characterized by the sodden, soft, fibrous texture, the rather long, more or less coalesced spines, the numerous, elongated cystidia and the large spores. This species received its name because of the numerous cystidia projecting uniformly from the sides of the spines, a character evident when examined under a microscope.

A minute fragment of the type of *Hydnum setulosum* was examined at the New York Botanical Garden by the senior author. He reports it characterized by smaller and less crowded spines than in Iowa specimens and differing in the possession of a broad, sterile border, as recorded in the original description. Iowa specimens were identical in color, texture and microscopic structure. An Iowa specimen, sent to Kew in order that it might be compared with a larger portion of the original specimen, was reported by Miss Wakefield to agree with the type.

Fairly common in Iowa. Collected in August through October on dead wood and one specimen was found on an old sporophore of Fomes. Apparently otherwise known only from the type locality in Alabama and from Manitoba.

2. STECCHERINUM OCHRACEUM (Fries) S. F. Gray, Nat. Arr. Brit. Pl. 1:651. 1821. (Plate VII, Figure 44)

Hydnum ochraceum Pers. ex Fries, Syst. Myc. 1:414. 1821.
Hydnum Rhois Schw. Schr. Nat. Gaz. Leipzig 1:103. 1822.
Hydnum pudorinum Fries, Elench. 1:133. 1828.
Hydnum flabelliforme Berk. Lond. Jour. Bot. 4:306. 1845.
Hydnum plumarium Berk. & Curt. Grevillea 1:97. 1873.
Climacodon ochraceus (Fries) Karst. Bidr. Finl. Nat. Folk. 37: 98. 1882.
Climacodon pudorinus (Fries) Karst. Bidr. Finl. Nat. Folk. 37: 97. 1881.

Leptodon pudorinum Quél. Fl. Myc. France 440. 1888.
Hydnum conchiforme Sacc. Syll. Fung. 6:458. 1888.
Mycoleptodon ochraceum Pat. Tax. Hymén. 116. 1900.
Steccherinum Rhois (Schw.) Banker, Mem. Torrey Club 12: 126. 1906.
Hydnum alnicolum Vel. České houby 745. 1922.

Fructification resupinate to reflexed or entirely pileate and laterally sessile, fibrous, tough, slightly separable, the upper surface of the pileus soft, tomentose, sulcate zoned, cartridge buff; hymenial surface pinkish cinnamon to vinaceous cinnamon; margin whitish, pubescent, subfimbriate, usually wider in the resupinate portions than in the reflexed; spines 2 mm. or less in length, crowded, 4-6 per mm., slender, subulate, pointed or terete, flattened, often divided, gradually decreasing in length toward the margin; hyphae thick-walled, 2-6 μ in diameter, coarser and less compactly interwoven next to the substratum or on the upper surface of the pileus, thin-walled in the sub-hymenial regions, with scattered clamp connections, and not exceeding 3.5 μ in diameter; cystidia 20-100 × 4-9 μ, numerous, projecting singly from the sides and the apices of the spines, elongated, clavate to cylindrical, slightly curved, arising from the parallel hyphae in the axial portion of the spine, thick-walled, usually heavily incrusted; basidia 12-15 × 3-5 μ, clavate; spores 3-4 × 2-2.5 μ, obovate, smooth, hyaline.

This species is recognized by its tough texture, ochraceous color, the numerous elongated and projecting, incrusted cystidia and the small, obovate spores. This fungus varies a great deal in its habit of growth. *Hydnum flabelliforme* Berk. and *Hydnum Rhois* Schw. seem to refer to the more pileate variations of the species.

Abundant in Iowa on dead wood of deciduous trees, especially oak; collected in all seasons. Apparently common throughout the United States.

3. STECCHERINUM LAETICOLOR (Berk. & Curt.) Banker, Mycologia 4:316. 1912. (Plate VII, Figure 45)

Hydnum laeticolor Berk. & Curt. Grevillea 1:99. 1873.
Irpex laeticolor (Berk. & Curt.) Morgan, Jour. Cinc. Soc. Nat. Hist. 10:15. 1887.
Mycoleptodon laeticolor (Berk. & Curt.) Pat. Tax. Hymén. 116. 1900.

Resupinate or with a slightly detached or reflexed margin, soft

spongy and slightly tough in texture, somewhat separable, zinc orange to orange-cinnamon; margin floccose, radially fimbriate, white or lighter in color; spines 2 mm. or less in length, irregular, flattened, serrate or divided, *Irpex*-like, obtuse; hyphae 3-6 μ in diameter, thick-walled, with scattered clamp connections; cystidia 5-9 μ in diameter, cylindrical, elongated, incrusted, projecting from the sides and apices of the spines; basidia 8-15 × 3-5 μ, clavate; spores 4-5.5 × 3-3.5 μ, ellipsoid, smooth, hyaline.

S. laeticolor bears such a close resemblance to *S. ochraceum* that one might be led to question the validity of giving it specific ranking. However, it may be separated in most cases by the more reddish color, the soft texture, the radially fimbriate margin, the irregular teeth and the larger spores. The slightly larger spores are diagnostic.

Uncommon in Iowa; collected in August and February. Widely reported from the central and eastern United States. Apparently more common in the southern states.

4. STECCHERINUM SEPTENTRIONALE (Fries) Banker, Mem. Torrey Club 12:130. 1906. (Plate VII, Figure 46)

Hydnum septentrionale Fries, Syst. Myc. 1:414. 1821.
Climacodon septentrionalis Karst., Rev. Myc. 3:20. 1881.
Creolophus septentrionalis (Fries) Banker, Mycologia 5:293. 1913.

Fructification tough, fibrous, generally consisting of many sessile, horizontal pilei which are imbricate, confluent at the base and arising from a small, single point of attachment; single pilei more or less flattened, usually 3-15 cm. wide, 2-15 cm. long, reported up to 30 cm. wide and 20 cm. long, fibrous and pubescent on the upper surface, not zoned, at first white, becoming coarsely wrinkled and ochraceous buff in the herbarium; margin abrupt, slightly incurved; spines 6-18 mm. in length, 2-3 per mm., slender, terete, pointed, entire, reported milk-white, becoming prussian red to pecan brown in the herbarium; hyphae 3-6 μ in diameter, compactly interwoven, often agglutinated, with few clamp connections, usually accompanied by larger, scattered and apparently gelatinized hyphae measuring 6-11 μ in diameter; cystidia 30-50 × 10-16 μ, short, fusiform, thick-walled, projecting 10-25 μ; basidia 12-18 × 4-5 μ, clavate; spores 4-6 × 2.5-3.5 μ, ellipsoid, smooth, hyaline.

S. septentrionale is similar to *S. pulcherrimum* and the two have

often been confused. The former species, however, is dryer, tougher and remains a paler color in the herbarium. The present species also may be distinguished microscopically by the presence of fusiform cystidia and the absence of the two clamp connections at the septa of the hyphae. The many horizontal and usually joined pilei are quite characteristic for the species. A single cluster has been reported by Lloyd (1923) to weigh as much as 60 pounds.

The characters noted above for fresh fructifications of *S. septentrionale* have been taken largely from the description of Banker, since no living specimens have been seen. A number of dry specimens examined in eastern herbaria indicate a greater range in length of spines than reported by Banker, who described them as 17-18 mm. in length.

Collected on maple in August; not common in Iowa. Apparently occurring throughout the central and eastern United States.

5. STECCHERINUM PULCHERRIMUM (Berk. & Curt.) Banker, Mem. Torrey Club 12:129. 1906. (Plate VII, Figure 47)

Hydnum pulcherrimum Berk. & Curt. Hooker's Jour. Bot. and Kew Gard. Misc. 1:235. 1849.

Hydnum friabile Fries, Nova Acta R. Soc. Sci. Upsal. III. 1: 106. 1851.

Steccherinum agaricoides (Swartz) Banker, Mem. Torrey Club 12:130. 1906.

Creolophus pulcherrimus (Berk. & Curt.) Banker, Mycologia 5:294. 1913.

Creolophus agaricoides (Swartz) Banker, Mycologia 5:294. 1913.

Fructification pileate, sessile, solitary to imbricate, dimidiate to flabelliform, often arising from a resupinate base, sometimes bell-shaped or convex, variable in size; texture soft, pliable, somewhat tough, fibrous, juicy when fresh and sometimes containing a milky white, sticky sap, soft and gummy to brittle when dry; color whitish at first, becoming light buff, tawny to liver brown in the herbarium; individual pilei up to 15 cm. in width and 8 cm. in length, 0.2-10 mm. thick at the base, densely fibrous or hairy on the upper surface; margin very thin; spines 1-6 mm. in length, usually about 5 mm., 4-5 per mm., slender, terete, pointed, entire, tawny in the herbarium; hyphae 4-6 μ in diameter, loosely packed in the pileus, with slightly thickened walls, with numerous clamp connections,

often two at each septum, more fragile and with fewer clamp connections in the spines, 2-3 μ in diameter; basidia 12-18 × 3-4 μ, clavate; spores 4-5 × 2-2.5 μ, variable, ellipsoid, slightly depressed laterally, smooth, hyaline.

The soft, somewhat fibrous texture, the tawny color, the white, sticky sap when fresh and the two clamp connections at many of the septa of the coarse hyphae are well marked characters in this species. These double clamp connections are sometimes few in number but in the several dozen specimens examined, they have always been present. After examining at the New York Botanical Garden the Murrill and Harris specimen, No. 1095, which Banker regards as representing *Hydnum agaricoides* Swartz, the senior author decided that it was a young growth of *S. pulcherrimum*, since it agreed in every microscopic detail with a typical fructification of this species. It varied, however, in the slightly more fleshy texture and the shorter teeth.

Rather uncommon in Iowa. Collected on dead wood of various frondose species from June to September. Widely reported from the eastern half of the United States.

6. STECCHERINUM ADUSTUM (Schw.) Banker, Mem. Torrey Club 12: 132. 1906. (Plate VII, Figure 48)

Hydnum adustum Schw. Schr. Nat. Ges. Leipzig 1: 103. 1822.

Fructification pileate, usually laterally stipitate but occasionally eccentric, mesopodous or sessile, soft, watery, subfleshy to tough and fibrous, brittle in the herbarium; pileus dimidiate, flabelliform or reniform, with a resupinate base, often subimbricate with abortive or fully formed pilei arising from the upper surface of lower ones, 3-7 cm. wide, 2-4 cm. long, more or less flattened, depressed toward the substratum or stipe, with a finely pubescent, slightly duller than cinnamon buff surface, faintly zoned toward the margin; spines 1-3 mm. in length, 4-5 per mm., slender, terete, angular or flattened, sometimes coalescing, often divided at the apex, whitish at first, turning pinkish in drying, becoming russet in the herbarium; hyphae 2-5 μ in diameter, quite homogeneous in the pileus, thick-walled in the pileus and axial portion of the spines, with scattered clamp connections; basidia 8-15 × 3 μ, clavate; spores 2.5-3 × 1-1.-25 μ, minute, short cylindrical, smooth, hyaline or granular.

This species may be recognized by the more or less dry, tough, reniform pileus which usually has a short, stout, lateral stipe and

by the minute spores. *Steccherinum pusillum* (Brot.) Banker is similar but may be separated by the distinctly zonate pileus and the ovoid spores.

Collected in Iowa on dead wood from July to November. Fairly common. Apparently widely distributed in the eastern United States and Canada.

7. STECCHERINUM RAWAKENSE (Pers.) Banker, Mycologia 4:312. 1912. (Plate VII, Figure 49)

Hydnum rawakense Pers. in Freyc. Voy. Aut. Monf. Bot. 175. 1826.

Hydnum reniforme Berk. & Curt. Jour. Linn. Soc. 10:325. 1869.

Hydnum glabrescens Berk. & Rav. Grevillea 1:97. 1873.

Hydnum guaraniticum Speg. Anal. Soc. Cl. Argent. 17:74. 1884.

Hydnum basiasperatum P. Henn. Hedwigia 36:199. 1897.

Steccherinum Morgani Banker, Mem. Torrey Club 12:127. 1906.

Steccherinum reniforme (Berk. & Curt.) Banker, Mem. Torrey Club 12:127. 1906.

Pileus tough, fibrous, brittle in the herbarium, horizontal, reniform to flabelliform, more or less flattened, laterally sessile or substipitate, occasionally with a small resupinate base, closely imbricate, often confluent toward the base; upper surface sulcate-zoned, glabrous or subpubescent with very short, coarse hairs, cinnamon in the herbarium; spines 2.5 mm. or less in length, 4-5 per mm., slender, terete or angular, subulate, pointed, chestnut brown in the herbarium; hyphae 2.5-6 μ in diameter, thick-walled in the pileus and the axial portion of the spines, without clamp connections; cystidia 15-30 × 5-9 μ, short fusiform, pointed, thick-walled, entirely hymenial, projecting about 10 μ; basidia 12-15 × 4 μ, clavate; spores 3-4 × 2 μ, ellipsoid, smooth, hyaline.

This species resembles *Steccherinum adustum* in size, texture and general appearance but the pileus is usually less stipitate and more distinctly zoned, the spores larger and cystidia are present. The cystidia and larger spores also distinguish this species from *S. pusillum* (Brot.) Banker. The senior author examined the specimen at the New York Botanical Garden referred by Morgan to *Hydnum glabrescens* Berk. & Rav. and upon which Banker erected *Steccher-*

inum Morgani. He found it to be identical in microscopic detail with *S. rawakense* (Pers.) as that species was understood by Banker. The slight differences in the external characters of this specimen from the typical condition in *S. rawakense* do not seem sufficient grounds for separating it as a distinct species. The type of *Hydnum glabrescens* was also studied at the New York Botanical Garden. The original description of *Hydnum rawakense* Pers. has not been seen. The citation is taken from Banker.

Collected once in Johnson County, Iowa, in November. Reported from several scattered localities in the eastern United States.

8. STECCHERINUM PUSILLUM (Fries) Banker, Mycologia 4:313. 1912. (Plate VIII, Figure 50)

Hydnum pusillum Brot. ex Fries, Syst. Myc. 1:407. 1821.
Steccherinum adustulum Banker, Mem. Torrey Club 12:133. 1906.

Pileus tough, fibrous, brittle in the herbarium, laterally stipitate or sessile, reniform or somewhat irregular, whitish with slightly darker zones on the upper surface; spines 2 mm. or less in length, 5-7 per mm., slender, flexuous, terete to flattened; cystidia absent; hyphae 2.5-4 μ in diameter, thick-walled, without clamp connections; basidia 10-15 × 3.5-5 μ, clavate; spores 2-2.5 × 1.5 μ, ovoid, smooth, hyaline.

S. pusillum has been reported from Iowa but no specimen believed to represent this species has been found in the University of Iowa herbarium. The above notes were made after studying the type of *S. adustulum* at the New York Botanical Garden. This species seems closely related to *S. rawakense* and *S. adustum.*

VIII. AURISCALPIUM S. F. Gray, Nat. Arr. Brit. Pl. 1:650. 1821; Karsten, Medd. Soc. Faun. Fl. Fenn. 5:27. 1879; *Pleurodon* Quélet, in Cooke and Quélet, Clav. Hymen. 198. 1878, emend. Karsten, Rev. Myc. 9:19. 1881; *Leptodon* Quélet, Ench. Fung. 191. 1886, in part.

Type species: ***Auriscalpium vulgare*** S. F. Gray (***Hydnum auriscalpium*** L.)

Pileus entire or lobed, laterally stipitate, leathery; spines slender, subulate; cystidia, if present, little differentiated; spores hyaline, small. Growing usually on cones of conifers.

This genus is distinguished from *Steccherinum* by the slender

stipe. Intermediate species occur, however, in which the pileus may be laterally short stipitate as in *S. adustum* and *S. reniforme*.

As treated by Quélet (1878) *Pleurodon* was equivalent to the tribes *Pleuropus* and *Apus* of the genus *Hydnum* of Fries. Later (1886 and 1888) Quélet seems to have substituted the name *Leptodon* for essentially the same group. He did not recognize the generic distinction between the forms with lateral stipes and those with resupinate, reflexed or laterally sessile pilei. In this broad sense his genus includes a number of Steccherinums. In 1879 Karsten erected a new genus *Auriscalpium* on *Hydnum auriscalpium* L. and two other species, which is antedated by *Auriscalpium* S. F. Gray. Most of the remaining species which Quélet included in *Pleurodon*, Karsten distributed in two or three other genera. In 1881, Karsten seems to have substituted Quélet's name *Pleurodon* for his own *Auriscalpium*. The name *Pleurodon* in this restricted sense is in common usage in Europe.

AURISCALPIUM VULGARE S. F. Gray, Nat. Arr. Brit. Pl. 1:650. 1821. (Plate VIII, Figure 51)

Hydnum Auriscalpium L. ex Fries, Syst. Myc. 1:406. 1821.
Pleurodon Auriscalpium (Fries) Quél. in Cooke & Quél. Clav. Hymen. 198. 1878.
Leptodon Auriscalpium Quél. Ench. Fung. 192. 1886.
Auriscalpium Auriscalpium (Fries) Banker, Mem. Torrey Club 12:178. 1906.

Pileus 1-2 cm. wide, horizontal, cordate to reniform, supported laterally, slightly convex, leathery, finely hispid, bister to almost black; stipe vertical, 1-6 cm. long, slender, leathery, finely hispid, bister to almost black in the upper portion, swollen, spongy and a lighter shade of brown at the base; spines 1.5 mm. or less in length, 4-5 per mm., slender, terete, acute; hyphae 2-6 μ, with thickened walls and few clamp connections, faintly colored, compactly arranged, fascicled to some extent in the pileus and the stipe; cystidia occasionally present, 15-30 × 3-6 μ; thin-walled, subulate; basidia 15-20 × 5-6 μ, clavate, with 2-4 sterigmata; spores 4.5-5 × 3.5-4 μ, obovate, apiculate or slightly attenuated at the base, smooth or minutely papillose, hyaline.

This species is recognized by the slender, vertical stipe, the reniform, laterally supported pileus, the dark color and hispid character of the stipe and pileus.

On decaying cones of conifers; June to November. Rare in Iowa. Reported from Oregon, Arizona and from various localities in the central and eastern United States.

IX. HERICIUM Pers. ex. S. F. Gray, Nat. Arr. Brit. Pl. 1: 652. 1821; *Medusina* Chev. Fl. Gen. Env. Paris. 278. 1826; *Dryodon* Quélet, in Cooke and Quélet, Clav. Hymen. 198. 1878; *Friesites* Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 27. 1879; *Manina* Scop. ex. Banker, Mycologia 4: 275. 1912.

Type species: ***Hericium coralloides*** Persoon ex. S. F. Gray.

Fructification fleshy or subfleshy, nodulose, tuberculiform or branched; spines mostly subulate, long and pendent; gloeocystidia usually present; spores spherical or subspherical, guttulate. Growing on wood.

Hericium Pers. was considered by Fries in the Systema Mycologicium as synonymous with his tribe *Merisma* of the genus *Hydnum*. In 1825 Fries recognized *Hericium* as a genus but in a different and questionable sense (Banker, Mycologia 4: 275. 1912). Regardless of Fries's treatment of *Hericium* the name may still be used since S. F. Gray in 1821 clearly defined the genus and published with it the same single species *H. coralloides* which appeared in the original description of *Hericium* by Persoon (1794).

KEY TO THE SPECIES OF HERICIUM

a. Fructification consisting of a mass of branching processes; spores 4-7 μ in diameter ---------- b

a. Fructification massive, rarely showing a tendency to form branching processes; spines long, 1-4 cm. in length, more or less uniform in size and distribution ---------- 1. *H. Erinaceus*

b. Intricately branched and anastomosing; spines seldom over 6 mm. in length, more or less uniformly distributed on the underside of the slender branches; spores 4-5 × 3-4 μ in diameter ---------- 2. *H. laciniatum*

b. Main branches few, short, relatively stout; spines 5-15 mm. in length, typically in fascicles at the ends of the terminal branches or on short lateral spurs; spores 5.5-7 μ in diameter ---------- 3. *H. coralloides*

1. HERICIUM ERINACEUS (Fries) Pers. Myc. Eu. 2: 153. 1825. (Plate VIII, Figure 52)

Hydnum Erinaceus Bull. ex Fries, Syst. Myc. 1: 407. 1821.
Medusina patula Chev. Fl. Gen. Env. Paris 1: 279. 1826.

Dryodon Erinaceus (Fries) Quél. in Cooke & Quél. Clav. Hymen. 198. 1878.

Manina cordiformis Scop. ex Banker, Mycologia 4:277. 1912.

Fructification a solid or porous, slightly flattened, massive body, laterally attached, bearing on the lower and outer portions long, downward-directed spines, soft, fleshy, whitish, becoming warm-buff to various shades of brown in the herbarium; spines 1-4 cm. long, curved, terete, acute, more or less coalesced at the base, often merging to shorter, flexuous and sterile spines or hairs on the upper surface; hyphae 3-20 μ in diameter, with occasional clamp connections; gloeocystidia 5-9 μ in diameter, arising from the subhymenial region, conspicuous by the highly refractive content; basidia 25-40 × 5-7 μ, with 4 sterigmata; spores 5-6.5 × 4.5-5 μ, subspherical, smooth, hyaline, 1-guttulate.

The massive fructification with the long cylindrical spines clearly distinguishes this species. *Hydnum Caput-Medusae* Bull. ex Fries is believed to represent a variation in which deformed spines are more apparent on the upper surface and the massive body shows some tendency of being made up of dividing and anastomosing processes.

Common in Iowa on living oak trees and dead wood of various frondose species from May to November. Widely reported from the United States.

2. HERICIUM LACINIATUM Leers ex Banker, Mem. Torrey Club 12:114. 1906. (Plate VIII, Figure 53)

Hydnum coralloides Scop. ex Fries, Syst. Myc. 1:408. 1821, in part.

Medusina coralloides Chev. Fl. Gen. Env. Paris 1:279. 1826.

Manina flagellum Scop. ex Banker, Mycologia 4:276. 1912.

Fructification consisting of a repeatedly dividing and more or less anastomosing mass of branches, arising from a common base which usually penetrates the substratum, soft, fleshy, whitish, becoming cream-buff to russet in the herbarium; spines 1-6 mm., terete, subulate, acute, more or less uniformly distributed on the under side of the branches, often borne on the upper side of the terminal branchlets; hyphae 3-20 μ in diameter, with occasional clamp connections; gloeocystidia 5-7 μ in diameter, arising from the subhymenial region and penetrating the hymenium, containing

a yellowish, refractive material; basidia 20-35 × 5-6 μ, clavate, slightly guttulate; spores 4-5 × 3-4 μ, smooth, hyaline, 1-guttulate.

This species is readily recognized by the white, intricately branched fructification. It is more intricately branched than *H. coralloides*, has shorter and more uniformly distributed spines and smaller spores. According to Banker (1906 & 1912) this species was named *Hydnum flagellum* by Scopoli (1772), *Hydnum laciniatum* by Leers (1775), and *Hydnum ramosum* by Bulliard (1791) and is distinct from *H. coralloides* Scop. Fries in the Systema Mycologicum considered Leers and Bulliard's names as synonyms of *Hydnum coralloides* Scop., and this viewpoint has been followed by most mycologists since. The senior author, after having examined a number of specimens of *coralloides* Scop. collected in America and Europe, agreed with Banker that the forms commonly included under this name represent two valid species.

Common in Iowa on dead logs of frondose species from August to November. Widely reported from the United States. Probably more generally known as *Hydnum coralloides*.

3. HERICIUM CORALLOIDES Scop. ex S. F. Gray, Nat. Arr. Brit. Pl. 1: 652. 1821. (Plate VIII, Figure 54)

Hydnum coralloides Scop. ex Fries, Syst. Myc. 1: 408. 1821, in part.

Dryodon coralloides (Fries) Quél. in Cooke & Quél. Clav. Hymen. 198. 1878.

Friesites coralloides (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5: 27. 1879.

Fructification usually consisting of several relatively short, stout, main branches from which short and more slender terminal branches arise, soft, fleshy, whitish, becoming warm-buff to various shades of brown in the herbarium; spines 5-15 mm. in length, terete, acute, usually arising in terminal clusters or on short lateral nodules from the sides of the main branches; hyphae 3-20 μ in diameter, with occasional clamp connections; gleocystidia 6-8 μ in diameter, sometimes emerging up to 25 μ; basidia 20-45 × 5-6 μ, clavate; spores 5.5-7 μ, spherical, smooth, hyaline, 1-guttulate.

Hericium coralloides merges gradually into the form commonly known as *H. Caput-Ursi*. Whether the two should be regarded as distinct is uncertain since a gradual series may be built up from one to the other. The two extremes of the series are quite different in

general appearance. Specimens of both species examined at the New York Botanical Garden and in other herbaria do not differ in microscopic characters.

The branching fructification of *Hericium coralloides* closely resembles that of *H. laciniatum* but may be separated at once by the larger spores. The two, however, have often been confused. For example, of ten specimens labelled *H. coralloides* by ten European mycologists at the New York Botanical Garden, six were *H. coralloides* as here defined and four were *H. laciniatum*. The species concepts of *H. coralloides* and *H. laciniatum* as here employed are those of Banker.

Uncommon in Iowa. Collected from August to October. Although widely reported from the United States, many of these reports undoubtedly refer to *H. laciniatum*.

X. DENTINUM S. F. Gray, Nat. Arr. Brit. Pl. 1:397. 1821; *Tyrodon* Karsten, Rev. Myc. 3:19. 1881; *Hydnum* L. ex Fr. Syst. Myc. 1:397. 1821, emend. Pat. Hymén. Europ. 145. 1887; *Hypothele* Paulet ex Banker, Torreya 4:113. 1904.

Type species: ***Hydnum repandum*** Fries.

Pileus with a central stipe, fleshy, white or pale to pinkish cinnamon when fresh; spines subulate; spores white in mass, subspherical. Growing on the ground.

Dentinum is distinguished from related genera by its pale color and its hyaline, smooth spores.

DENTINUM REPANDUM (Fries) S. F. Gray, Nat. Arr. Brit. Pl. 1:650. 1821. (Plate VIII, Figure 55)

Hydnum repandum L. ex Fries, Syst. Myc. 1:400. 1821.
Tyrodon repandus (Fries) Karst. Rev. Myc. 3:19. 1881.
Sarcodon repandum (Fries) Quél. in Cooke & Quél. Clav. Hymen. 196. 1878.
Hydnum umbilicatum Peck, Bull. N. Y. State Mus. 10:953. 1902.
Hypothele repanda (Fries) Banker, Torreya 4:113. 1904.

Pileus up to 12 cm. in diameter, usually convex, but sometimes depressed, irregular, uneven; substance fleshy, soft, usually brittle, white; fructification colored cartridge buff to pinkish cinnamon when fresh, becoming warm buff to cinnamon-buff and wrinkled

when dry; odor and taste slight; margin repand; stipe smooth, solid, 7 cm. or less in length, color and texture as in pileus; spines 1-6 mm. in length, 2-4 per mm., soft, fleshy, fragile, subulate to occasionally flattened, slightly decurrent as short warts; hyphae 3-12 μ in diameter, thin-walled, with scattered clamp connections; basidia 25-40 × 5-9 μ, clavate, with four sterigmata; spores 7-9 × 6.5-7.5 μ, obovate to subspherical, with a prominent apiculus, smooth, white in mass.

Hydnum repandum is characterized by the pallid to pinkish cinnamon, fleshy fructification which occurs strictly on the ground, and by the large obovate, prominently apiculate spores. It varies considerably in size, color and character of the spines.

Common in Iowa. Collected from August through October. Its occurrence is widely reported throughout the United States.

XI. CALDESIELLA Sacc., Michelia 1:7. 1877. *Odontia* Pat. Hymén. Europ. 149. 1887; *Acia* subgen. *Aciella* Karsten, Finl, Basid. 362. 1889; *Amaurodon* Schroeter, Krypt.-Fl. Schles. 3_1:461. 1888; *Phaeodon* sect. *Hydnopsis* Schroeter, Krypt.-Fl. Schles. 3:458. 1889.

Type species: ***Caldesiella italica*** Sacc.

Fructification resupinate, soft, floccose, dark; spines soft, conical; cystidia not present; spores colored, spherical or subspherical, roughened. Growing on wood.

This genus is closely related to *Tomentella* of the Thelephoraceae, from which it is distinguished by the presence of distinct spines. It may readily be separated from *Asterodon* and *Hydnochaete* by its roughened spores and lack of setae. The mycelial and spore characters suggest more or less close relationship with the two stipitate genera, *Hydnum* and *Calodon*. These three genera were combined in the single genus *Phaeodon* by Schroeter in 1889. The dark mycelium and dark, roughened spores were considered sufficiently distinct by Patouillard in 1900 to justify removing *Caldesiella*, *Sarcodon (Hydnum)* and *Calodon* from the Hydnaceae and placing them with *Phylacteria* and *Tomentella* of the Thelephoraceae in the new family Phylacteriaceae.

Caldesiella was erected in 1877 on the single species *C. italica* Sacc. and placed in the gasteromycetes. In 1881 Saccardo transferred *Hydnum ferruginosum* Fries to *Caldesiella* and correctly listed it with the hymenomycetes. Unfortunately *C. italica* grades

into *Tomentella* and is therefore not as typical a hydnum as is *C. ferruginosa* (Fries) Sacc., nor is it as common. According to our interpretation of the rules *C. italica,* however, must be regarded as the type.

CALDESIELLA FERRUGINOSA (Fries) Sacc. Michelia 2:303. 1881. (Plate IX, Figure 56)

Hydnum ferruginosum Fries, Syst. Myc. 1:416. 1821.
Hydnum ferrugineum Pers. Myc. Eu. 2:189. *non* Fries. 1825.
Hydnum crinale Fries, Epicr. 516. 1838.
Acia ferruginea (Pers.) Karst. Bidr. Finl. Nat. Folk 37:112. 1882.
Odontia Barba-Jovis Pat. Tab. Fung. 3:110. 1884, *non* Fries.
Hydnum tabacinum Cooke, Grevillea 14:129. 1886.
Phaeodon tomentosus Schrad. ex Schroet. Krypt.-Fl. Schles. 3_1: 458. 1888.
Acia tomentosa Schrad. ex Karst. Bidr. Finl. Nat. Folk 48:362. 1889.
Odontia crinalis (Fries) Bres. Atti Accad. Rovereto 3:96. 1897.
Odontia ferruginea Pers. ex Banker, Bull. Torrey Club 29:439. 1902.
Caldesiella crinalis (Fries) Bourd. & Galz. fide Rea, Brit. Basid. 651. 1921.

Resupinate, effused, floccose, slightly separable, ochraceous-tawny to mummy brown; margin similar or slightly lighter in color; spines subulate, conical, acute, terete, 2 mm. or less in length; hyphae 2-5 μ in diameter, loosely interwoven and in slender branching strands in the subiculum, with numerous clamp connections, mostly dark colored; basidia 40-60 × 6-8 μ, cylindrical, with 2-4 prominent sterigmata measuring 5-8 μ in length, becoming colored; spores 8-10 × 7-9 μ, subspherical, tuberculate, benzo brown in mass.

This species is well marked. The dark-colored, tomentose, resupinate fructification and the large, dark, tuberculate spores are distinctive characters.

A number of specimens were collected in Iowa from August to November in 1931 and 1932. The log from which collections were made was lying in a recently cleared pasture. When first collected the fungus covered a considerable area of the underside of the log and had crept over about 8 square inches of ground thereunder.

The portion on the ground bore distinctly upright spines. In addition to the above reported collection, a small specimen was found at Milford, Iowa, in 1932.

Uncommon in Iowa. It is known from Manitoba, California, and at least eight central and eastern states. A fragment of the type of *Hydnum tabacinum* Cooke, a specimen of *Hydnum crinale* Fries from the herbarium of Fries, and a specimen of *Odontia crinalis* (Fries) from Bresadola were studied at the New York Botanical Garden and seem to be identical with specimens collected in America.

XII. HYDNUM L. emend. S. F. Gray, Nat. Arr. Brit. Pl. 1: 650. 1821. Fries, Syst. Myc. 1: 397. 1821, in part. *Sarcodon* Quélet, in Cooke and Quélet, Clav. Hymen. 195. 1878. emend. Karsten, Rev. Myc. 3: 20. 1881.

Type species: ***Hydnum imbricatum*** L.

Pileus with a central stipe, fleshy to subfleshy, generally dark colored; spines subulate, simple; spores small, subspherical, angular or echinulate, brown. Growing on wood.

This genus is separated from *Calodon* by its fleshy texture and from *Dentinum* by its dark color and roughened spores. Fries, in the Systema Mycologicum, referred a very large and heterogeneous group, comprising all species with awl-shaped spines, to the genus *Hydnum*. As thus defined, *Hydnum* includes a large majority of the species of the family, ranging from the simple resupinate forms to the more specialized stipitate forms. It is obviously desirable to separate such a large and heterogeneous group into smaller and more homogeneous genera. The various attempts to do this have resulted in a comparatively large number of proposed segregates and generic names. The application of the name *Hydnum* has varied considerably.

In 1821 S. F. Gray erected a number of new genera in the *Hydnaceae* and retained the name *Hydnum* for certain of the fleshy, mesopodous species, of which *Hydnum imbricatum* only was mentioned. Since the fleshy mesopodous *Hydnum repandum* was transferred to his new genus *Dentinum*, it is apparent that *Hydnum* as used by Gray is identical with *Sarcodon* Quél. emend. Karsten in common usage today. Quélet (1878) and Karsten (1881) applied the name *Hydnum* to the large number of resupinate species which

at that time had not been transferred to other recognized resupinate genera, such as *Odontia* and *Grandinia*. Patouillard (1887) was the first to restrict the name *Hydnum*, as now commonly used, to the fleshy, mesopodous, white-spored forms growing on the ground. In 1900 Patouillard enlarged the boundaries of the genus to include also *Hericium* Pers. and *Dryodon* Quél. Banker, Bourdot and Galzin, and Cejp follow Patouillard's earlier conception. Gäumann and Dodge state that *Hydnum repandum* is the type. Clements and Shear, however, indicate *H. imbricatum* as the type. *Hydnum* as used by Coker (1919) is antedated by *Sarcodon* Quél. Hennings and Killermann (old and new edition of Engler and Prantl) and Rea retain in large part the Friesian concept of the genus.

Hydnum repandum is the nomenclatorial type of *Hydnum* according to common usage. That species, however, must be referred to *Dentinum* and therefore cannot serve as the type of *Hydnum*. According to the international rules it seems that *Hydnum imbricatum* L. ex Fries must be regarded as the type. In some respects it is unfortunate that this species should be regarded as the type of the type genus since neither the dark, tuberculate spores nor the dark hyphae of the fructification are as typical of the family as a whole as are the hyaline, smooth spores and pale hyphae of *Dentinum repandum*, which is also usually the commoner species. Nevertheless, if the two species are to be recognized as representing distinct genera, as seems amply justified, the rules seem clearly to necessitate citing *imbricatum* as the type of the genus *Hydnum*.

HYDNUM UNDERWOODII (Banker) Coker, Jour. Elisha Mitchell Soc. 34: 171. 1919. (Plate IX, Figure 57)

Sarcodon Underwoodii Banker, Mem. Torrey Club 12: 147. 1906.

Pileus with a central stipe, subplane, slightly convex to depressed at maturity, irregular, up to 5.5 cm. in diameter; margin nearly smooth or floccose, thin, inflexed, fertile, with short teeth; surface covered with minute or small scales, less apparent when young; color vinaceous brown, about fawn, grayish brown toward the margin; substance fleshy, whitish, elastic, drying hard and thin; stipe 4-5.5 cm. long, 0.5-1 cm. thick near center, sometimes swollen and fistulose, quite crooked, usually strongly bent at the ground, the base abruptly pure white, usually continuing to taper, radicating; spines small, slender, terete, acute, decurrent, scattered nearly to

base of stem, 0.6-0.7 mm. long when dried, brittle, light brown except for ashy-white tips; basidia 11-15 × 5-6 μ; spores 5-6 × 4-4.5 μ, roughly spherical, tuberculate, brown.

H. Underwoodii is readily recognized by its brown radicating stipe with its white root and root base, its strongly decurrent spines, and the vinaceous brown, scaly cap. It is readily separated from *Calodon* by its fleshy, elastic texture, and from *Dentinum* by its dark, tuberculate spores.

Uncommon in Iowa. Collected twice near Iowa City in August. Reported from the eastern United States.

XIII. CALODON Quél. in Cooke and Quélet, Clav. Hymen. 196. 1878; *Hydnellum* Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 27. 1879; *Phellodon* Karsten, Medd. Soc. Faun. Fl. Fenn. 6: 15. 1881.

Type species: ***Hydnum suaveolens*** Scop.

Pileate, stipitate, usually mesopodous but sometimes eccentric; fructification fibrous, tough, sometimes woody, dark colored, in some species thin and relatively homogeneous, in others composed of two layers of different texture, the upper soft and spongy, the lower hard and compact; spores subspherical, coarsely angular or echinulate, brown or subhyaline. Growing on the ground.

Calodon differs from both *Hydnum* and *Dentinum* in its tough, fibrous texture. Karsten in 1881 divided this genus into the white-toothed forms to which he gave the name *Phellodon*, and the dark toothed forms to which he assigned Quélet's name *Calodon* rather than his own name *Hydnellum*. This distinction was maintained by Banker and tentatively by Coker; both, however, applied the name *Hydnellum* to the group with dark spines. Banker (1906) described the spores of *Hydnellum* as "colored, coarsely tuberculate," and the spores of *Phellodon* as "white or hyaline, usually echinulate." However, the differences do not seem sufficiently distinct to warrant generic rankings for the two groups, since there is a gradual transition from the darker forms with coarse tuberculate spores to the less dark with echinulate, pale spores. *Hydnellum* and *Phellodon* do not seem to be two distinct groups with a few intermediate forms, but rather a single group which varies somewhat in color and in the roughened character of the spore.

KEY TO THE SPECIES OF CALODON

a. Pileus and teeth white to grayish brown; texture duplex, the upper portion soft and spongy, the lower hard and compact and extending into the stipe as a core; spores subhyaline, white in mass ---------- b
a. Pileus and teeth darker; spores distinctly brown to fuscous in mass ---------- c
b. Flesh highly hygrophanous, hard layer blue-black in color ---------- 1. *C. alboniger*
b. Flesh not hygrophanous, hard layer not blue-black in color ---------- 2. *C. amicus*
c. Pileus convex to plane, not zoned, consisting of two thick and conspicuous layers, a soft, spongy upper and a hard, compact lower layer which continues into and forms the core of the bulbous stipe; spores 5-6.5 μ, brown, tuberculate ---------- 3. *C. velutinus*
c. Pileus centrally depressed to infundibular, usually zonate, texture more or less homogeneous but, if duplex, not conspicuously so; spores 4.5-6 × 3.5-4.5 μ ---------- d
d. Pileus distinctly zonate, thin, occasionally roughened ---- 4. *C. zonatus*
d. Pileus weakly zoned, thicker, rougher ---------- e
e. Surface finely pubescent: if bruised when fresh exuding a reddish liquid ---------- 5. *C. ferrugineus*
e. Surface glabrous; if bruised when fresh not exuding a reddish liquid ---------- 6. *C. scrobiculatus*

1. CALODON ALBONIGER (Peck) Seeler, Rhodora 44:168. 1942. (Plate IX, Figure 58)

Hydnum albonigrum Peck. Ann. Rept. N. Y. State Mus. 50:110. 1897.

Phellodon alboniger (Peck) Banker, Mem. Torrey Club 12:167. 1906.

Pileus 1-7 cm. in diameter, with a central (sometimes eccentric) stipe, confluent, irregular, channeled, nearly plane or slightly depressed at the center; in section showing two distinct layers, spongy tomentose in the upper part of the pileus, blue-black in the lower hard and compact part and continuing as a core to the stipe; spines slender, terete, decurrent, not exceeding 2 mm., gray when dry; spores 3.5-4 μ, echinulate, pure white in mass; odor and taste not notable when fresh, but smelling of slippery elm when dry.

This species, while similar to *C. amicus* in many characters, differs markedly in the color of the hard, compact layer which forms the core of the stipe and in the hygrophanous character of the flesh.

Apparently rare in Iowa.

2. CALODON AMICUS Quél. Comp. Rend. Assoc. Fr. Av. Sci. 12:504. 1884. (Plate IX, Figure 59)

Hydnum amicum Quél. Grevillea 8:115. 1880.
Hydnum vellereum Peck, Ann. Rep. N. Y. State Mus. 50:110. 1897.
Phellodon vellereus (Peck) Banker, Mem. Torrey Club 12:168. 1906.
Phellodon amicus (Quél.) Banker, Mycologia 5:62. 1913.

Pileus single or confluent, up to 12 cm. in diameter, irregular, channeled, usually depressed at the center, tomentose, azonate to subzonate, with a broad, whitish marginal zone and brownish toward the center; texture duplex, consisting of a soft, felty outer layer and a hard, compact and woody inner layer or core; odor when fresh varying from disagreeable to none at all, in drying, fragrant, resembling slippery elm; taste slight; stipe varying greatly in size, 1-4 cm. long, 0.5-2 cm. in diameter, uneven, color of the older portions of the pileus; spines subulate, terete, crowded, 4-6 per mm., 2-4 mm. in length, shortening to the sterile margin, decurrent, white when fresh, becoming light gray to grayish brown when dry; hyphae 3.5-6 μ in diameter, firm-walled, faintly colored as seen under the microscope; basidia 20-30 × 4-5 μ; spores spherical, 3.5-4.5 μ, coarsely echinulate, subhyaline or faintly colored.

Specimens of *Phellodon vellereus* determined by Banker and *P. amicus* and *Hydnum amicum* determined by Banker and Patouillard, studied at the New York Botanical Garden, appeared quite like our Iowa specimens. *Hydnum putidum* is similar if not identical.

Common in Iowa during the summer and fall months. Reported from Washington and many of the eastern states.

3. CALODON VELUTINUS (Fries) Quél. in Cooke and Quél. Clav. Hymen. 197. 1878. (Plate IX, Figure 60)

Hydnum velutinum Fries, Syst. Myc. 1:404. 1821.
Hydnellum velutinum (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5:27. 1870.
Hydnum spongiosipes Peck, Ann. Rep. N. Y. State Mus. 50:111. 1897.

Pileus mesopodous, occasionally eccentric, convex, plane or occasionally depressed at the center, azonate, subrotund to strongly

irregular in age, 2-12 cm. in diameter, pilei frequently anastomosing, surface finely tomentose; substance duplex, composed of a soft felty upper layer and a hard compact lower part which extends through the stipe as a core; stipe 1-8 cm. long, 0.5-2.0 cm. in the upper part, becoming wider toward the base until quite bulbous, with a compact, hard, central core surrounded by a soft, felty layer, color of the pileus; spines decurrent, 1-6 mm. in length, 2-4 per mm., subulate, terete, acute, color of the pileus; hyphae 3-6 μ in diameter, fairly thick-walled, without clamp connections, seldom over 4.5 μ in diameter in the spines, brownish in color; basidia 24-45 × 5-8 μ; spores 5-6.5 μ, spherical, coarsely tuberculate, brown.

Since *C. velutinus* is fibrous and tough, it is long persistent. It is quite easy to mistake an old specimen for another species since there is quite a marked macroscopic difference between an old fructification and a young, vigorous one.

Common in eastern Iowa.

4. CALODON ZONATUS (Fries) Quél. in Cooke & Quél. Clav. Hymen. 197. 1878. (Plate IX, Figures 61 and 62)

Hydnum cyathiforme Bull. ex Fries, Syst. Myc. 1:405. 1821, in part.

Hydnum concrescens Pers. Myc. Eu. 2:164. 1825, in part.

Hydnum zonatum Batsch ex Fries, Epicr. 509. 1838.

Hydnellum zonatum (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5:27. 1879.

Phaeodon zonatus (Fries) Schroet. Krypt.-Fl. Schles. 3:458. 1888.

Hydnellum concrescens (Pers.) Banker, Mem. Torrey Club 12: 157. 1906.

Pileus mesopodous, sometimes eccentric, pilei frequently anastomosing, depressed in the center, sometimes subinfundibular, distinctly zoned, usually light colored at the margin to pecan brown or Vandyke brown at the center; substance tough, fibrous; stipe short, 0.5-2 cm. in length, 0.5-2 cm. in width above, wider and with a spongy, bulbous base below, color similar to the pileus; spines slender, terete, 1-3 mm. or less in length, 5-6 per mm., Vandyke brown, decurrent; hyphae 2.5-6.5 μ in diameter, appearing colored when seen under the microscope, without clamp connections; basidia 20-35 × 5-6 μ; spores 3.5-4.5 × 4.5-6 μ, subspherical, coarsely tuberculate, russet brown in mass.

Calodon zonatus seems to be closely allied to *C. ferrugineus* and *C. scrobiculatus*. Banker (1913) regards the latter two names as synonyms. Since these are maintained as distinct by more recent writers, Rea (1921), Bourdot and Galzin (1927) and other European workers, it seems best to keep them separate for the present.

Common in Iowa; on the ground from August to November. Widely reported from the United States.

5. CALODON FERRUGINEUS (Fries) Quél. in Cooke & Quél. Clav. Hymen. 196. 1878.

Hydnum ferrugineum Fries, Syst. Myc. 1:403, 1821. *non* Persoon.

Hydnellum ferrugineum (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5:27. 1879.

Phaeodon ferrugineus Schroet. Krypt.-Fl. Schles. 31:459. 1888.

Hydnellum sanguinarium Banker, Mem. Torrey Club. 12:152. 1906.

C. ferrugineus generally is distinguished from *C. zonatus* by the thicker and less zonate pileus, the whitish margin, the mass of irregular tubercles and subfertile pileoli in the center, and the reddish liquid which is exuded when the fructification is injured. The two forms are similar, however, and differ little in macro- and microscopic character. There is great similarity in herbarium material. The flesh pink or onion-skin pink margin of *C. zonatus* described by Coker suggests the pale margin of *C. ferrugineus*. After years of study and observation of fleshy hydnums, Banker apparently came to regard the red juice as having little weight in the separation of species.

Collected on rich humus in woods. August and September. Fairly common in Iowa. Widely reported from the eastern United States.

6. CALODON SCROBICULATUS (Fries) Quél. in Cooke & Quél. Clav. Hymen. 197. 1878.

Hydnum cyathiforme Bull. ex Fries, Syst. Myc. 1:405, in part. 1821.

Hydnum scrobiculatum Fries, Epicr. 509. 1838.

Hydnellum scrobiculatum (Fries) Karst. Medd. Soc. Faun. Fl. Fenn. 5:27. 1879.

C. scrobiculatus is generally separated from *C. zonatus* by the more rigid, thicker, less zonate and rougher pileus. Bourdot and

Galzin indicate that the fungus may be separated from *C. ferrugineus* by the smoother surface and the absence of a purplish liquid. Banker, however, regards *C. ferrugineus* and *C. scrobiculatus* as representing the same species. It seems equally plausible that *C. scrobiculatus* and *C. zonatus* represent one species. Many specimens, under both names, studied by the senior author at the New York Botanical Garden, clearly merged and were practically indistinguishable. Careful study of living material under natural conditions and in culture, if possible, seems highly desirable in order to determine satisfactorily whether these forms represent one or more species.

Both the original studies upon which this paper is based and the present revision were made in the mycological laboratory of the State University of Iowa under the direction of Professor G. W. Martin.

All illustrations are original and have been made either directly from the specimens or from microscopic mounts with the aid of a camera lucida. The microscopic details were drawn at a magnification of × 1680 and reduced to × 1000.

PLATE I. 1. *Mucronella aggregata*, immature and mature basidia; spores; calcium oxalate crystal; hyphae from base and axis of spine. 2. *Mucronella aggregata*, habit, showing a cluster of spines subtended directly from substratum, × 5. 3. *Mucronella Ulmi*, habit, showing a cluster of spines subtended directly from substratum, × 5. 4. *Mucronella Ulmi*, basidium; spores; thick and thin-walled hyphae from the base of a spine. 5. *Gloidon strigosus*, spores; basidium; thick-walled hyphae from the base of the spine. 6. *Gloidon strigosus*, habit, showing brownish tomentum and long slender spines, × 5. 7. *Grandinia granulosa*, showing a portion of the antler-like hypha and one spore. 8. *Grandinia farinacea*, basidia; spores; hyphae from the base of spine. 9. *Grandinia alnicola*, immature basidia; spores; hypha from the base of spine. 10. *Grandinia raduloides*, basidium; spores; guttulate hyphae from the base of spine.

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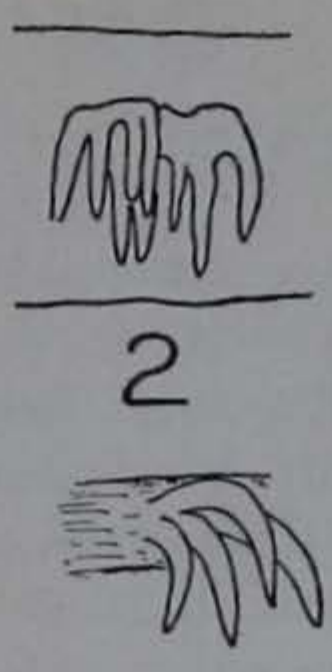

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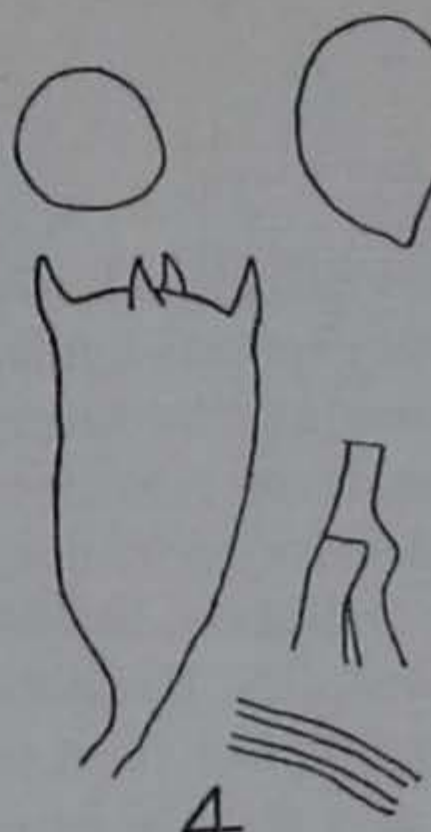

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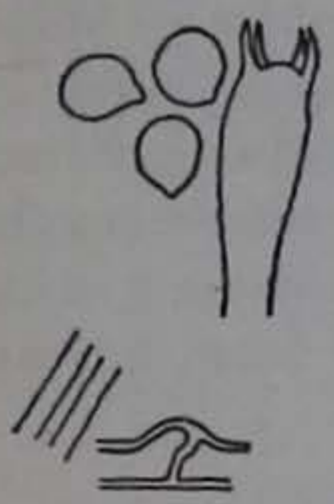

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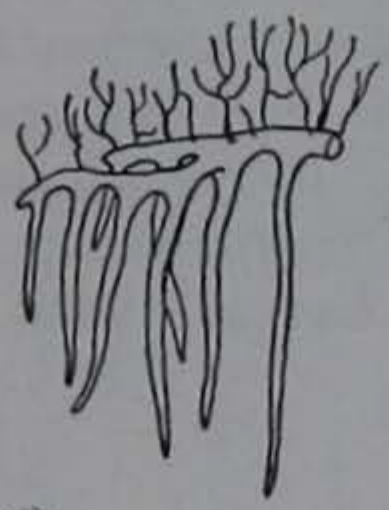

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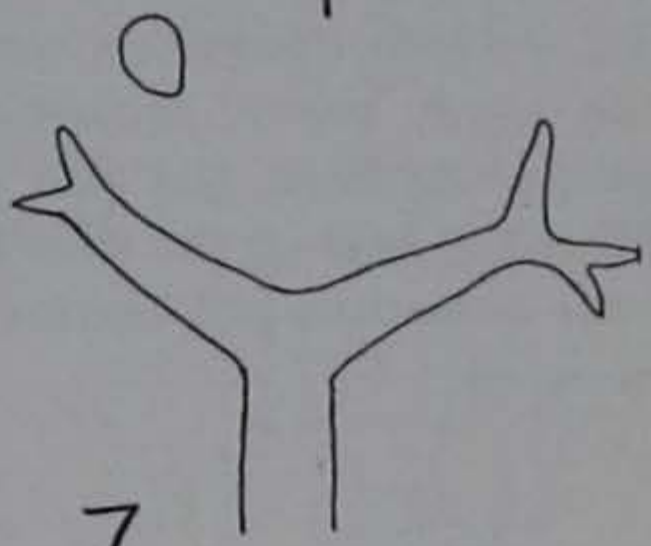

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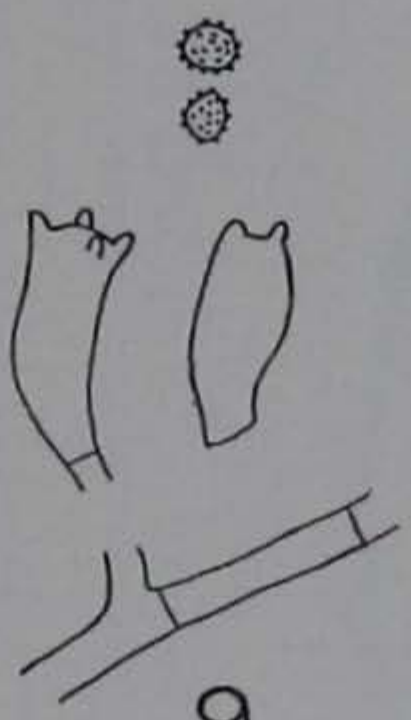

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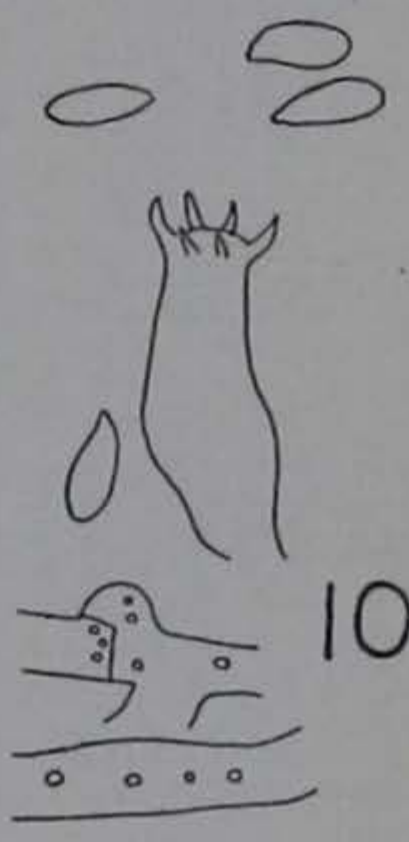

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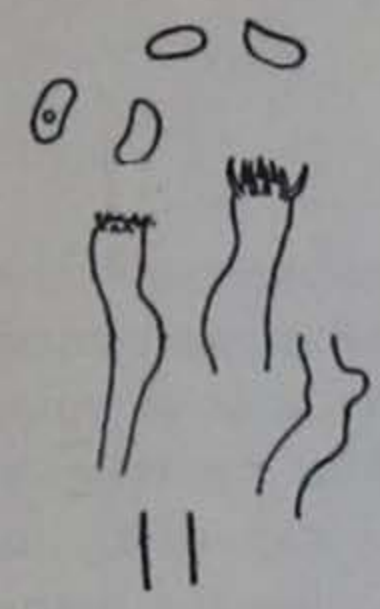
PLATE II. 11. *Grandinia Brinkmanni*, immature and mature basidia; spores; hypha from axial region of the spine. 12. *Grandinia helvetica*, immature and mature basidia; uniguttulate spores; hypha from mycelial strand. 13. *Grandinia mutabilis*, immature and mature basidia; spores; hypha from the base of spine. 14. *Radulum pallidum*, basidia; spores; thick-walled hyphae from the base of spine. 15. *Radulum quercinum*, immature and mature basidia; spore; hyphae from base of spine. 16. *Radulum orbiculare*, immature and mature basidia; spores; hyphae from the base of spine. 17. *Odontia hydnoides*, septate cystidium from the axial region of the spine, shown projecting from the apex; fusiform cystidium projecting from the side of the spine; basidium; spores; hypha from the base of the spine. 18. *Odontia Queletii*, fusiform cystidium; immature and mature basidia; spores; hyphae from the base of spine.



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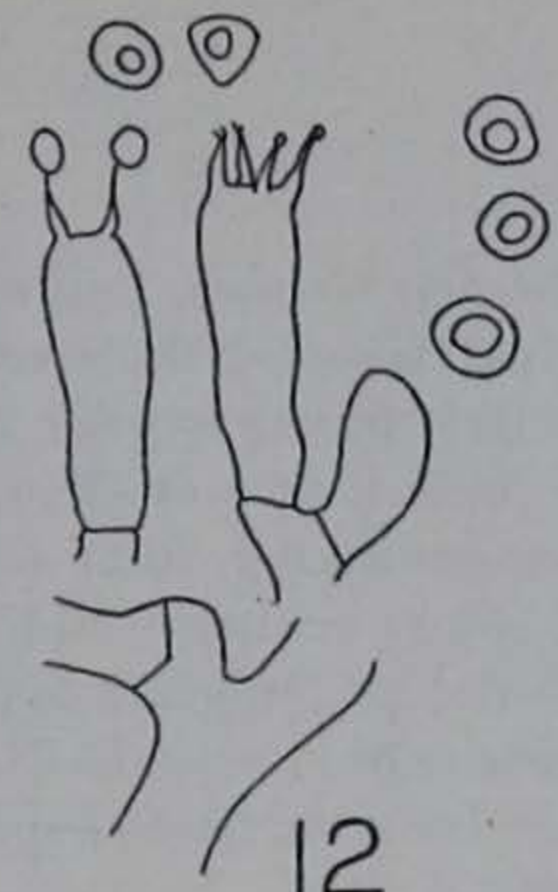

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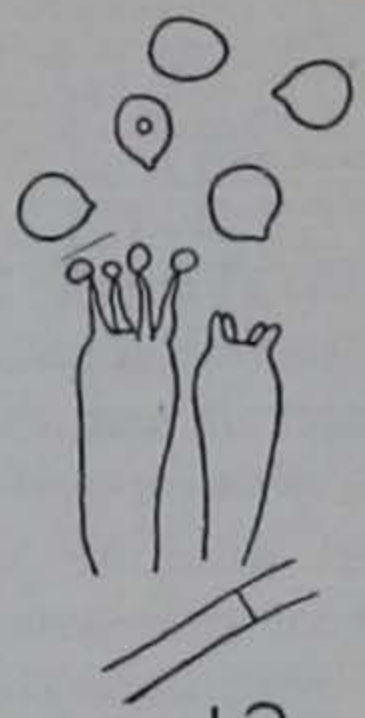

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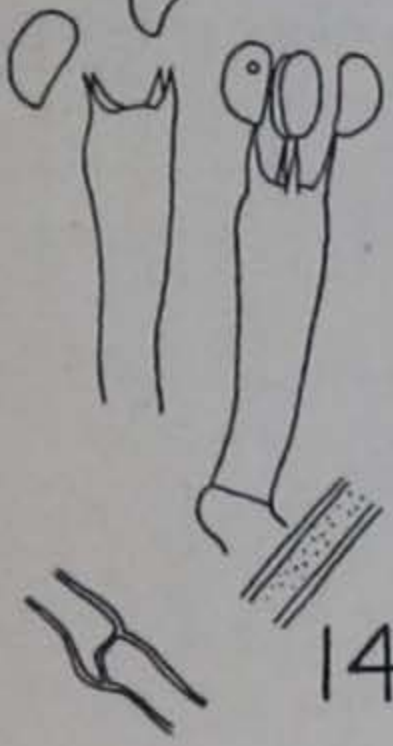

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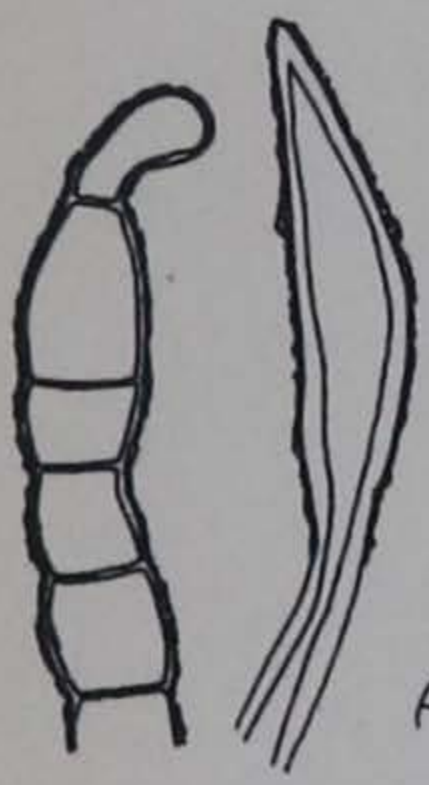

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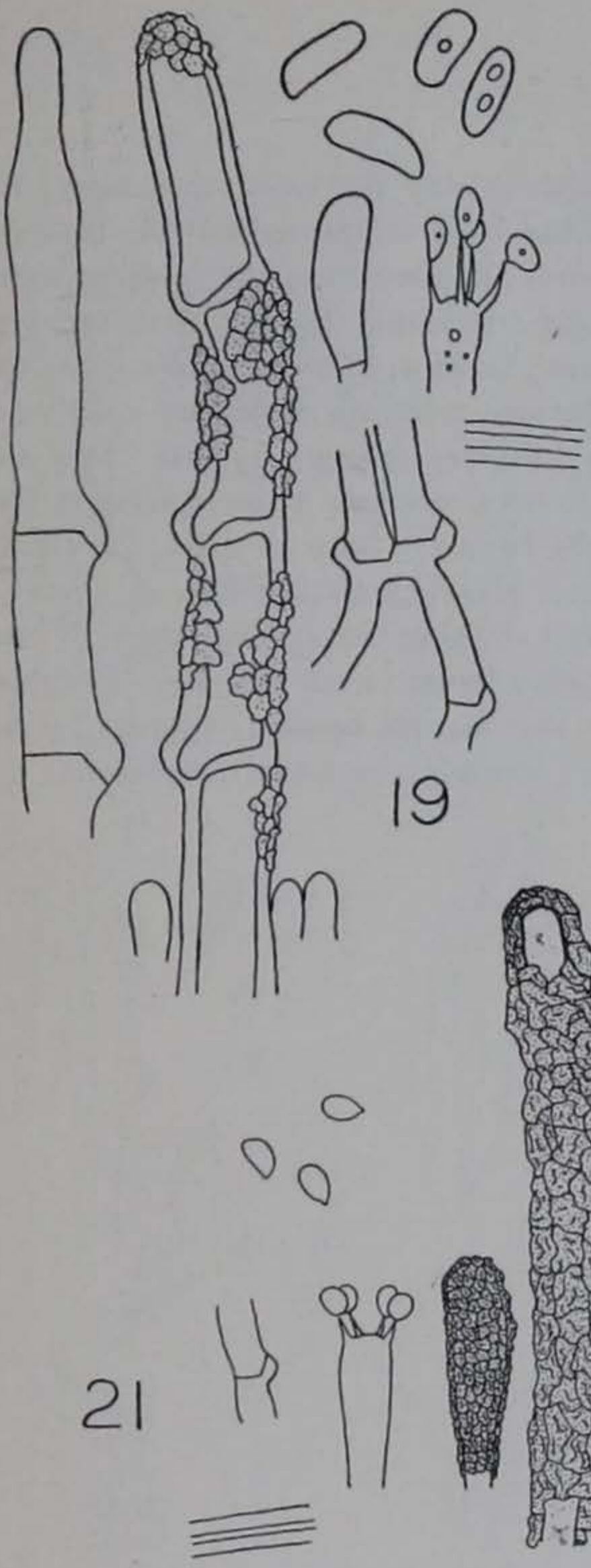
PLATE III. 19. *Odontia setigera*, thin-walled young cystidium; older cystidium showing thickened walls and incrustations; immature and mature basidia; spores; hyphae from the base of spine. 20. *Odontia fimbriata*, outline of a cystidium to show the relationship with the basidia, projecting from the apex and extending through the axis of a spine; mature cystidium showing the nature of the incrustation; basidium; spores; hyphae from the base of spine and from a rhizomorphic strand. 21. *Odontia ciliolata*, basidium; spores; hyphae from the base of spine; cystidia projecting from the side of a spine.



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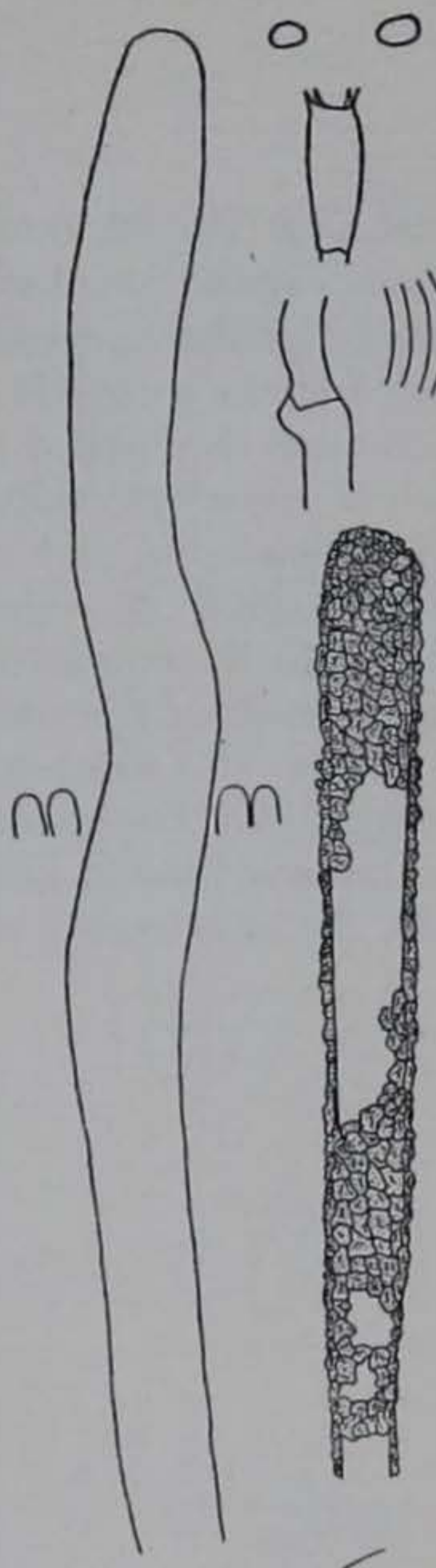

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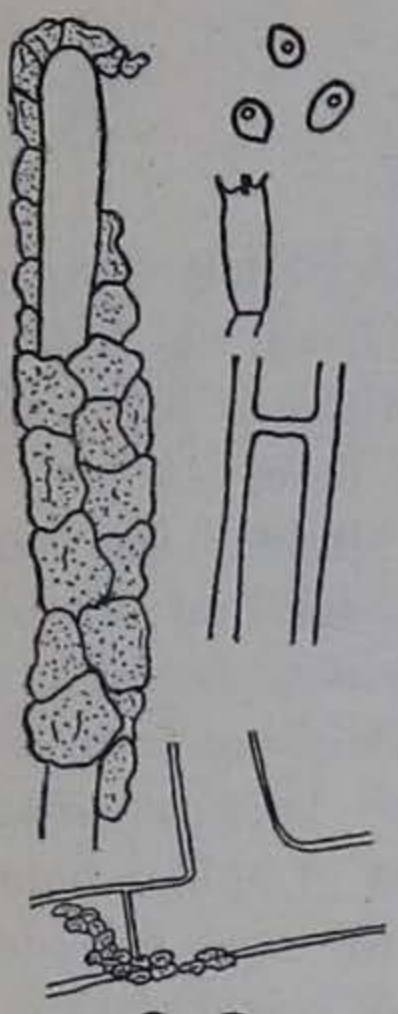
PLATE IV. 22. *Odontia laxa*, thickly incrusted cystidium; basidium; spores; hyphae from the base of the spine. 23. *Odontia sudans*, basidium; cystidia; spores; hyphae from the interior, axial region of the spine. 24. *Odontia cristulata*, slightly incrusted cystidia from the apex of the spine; basidia; spores; hypha from the base of spine. 25. *Odontia alutacea*, cystidia from the apex of a spine; immature and mature basidia; spores; hyphae from the base of spine. 26. *Odontia albicans*, cystidia from apices of two spines; basidium; spores; hypha from the base of spine. 27. *Odontia crustosa*, (a.) crushed mount showing relationship of cystidia to basidia; (b.) uncrushed mount showing the cystidia slightly projecting above the basidia; spores; hypha from the base of spine. 28. *Odontia bicolor*, immature and mature basidia; spores; hypha from the axial region of spine; terminal incrusted cystidium.



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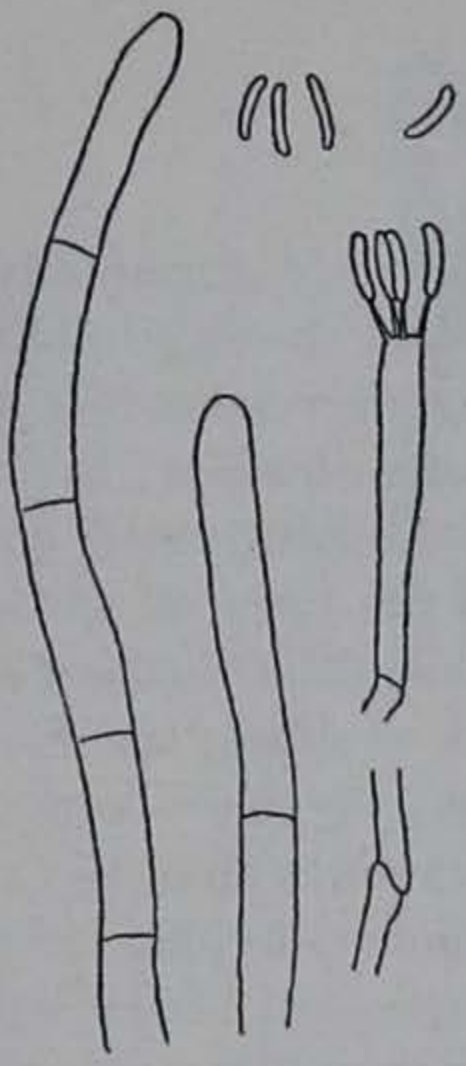

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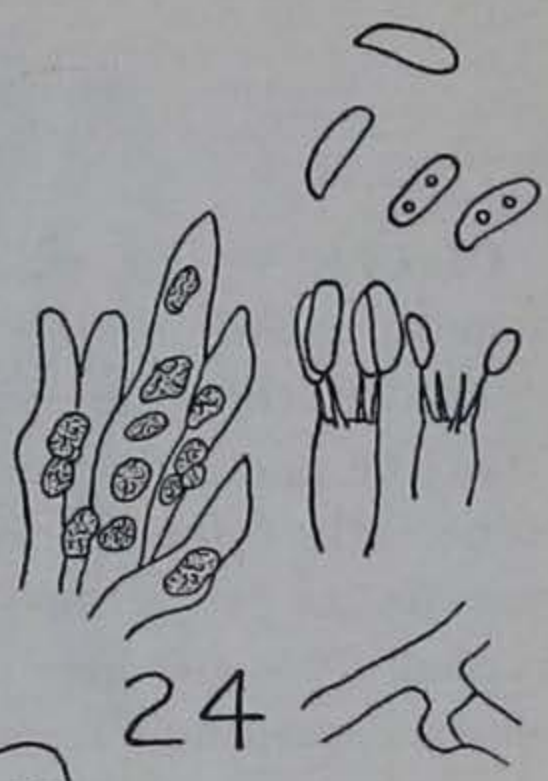

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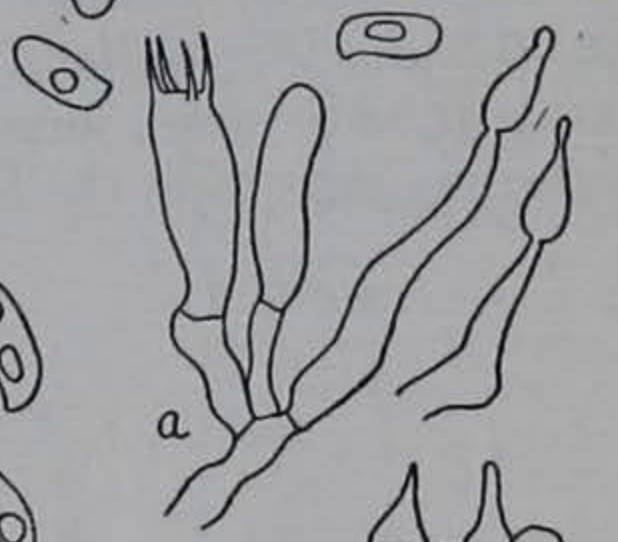

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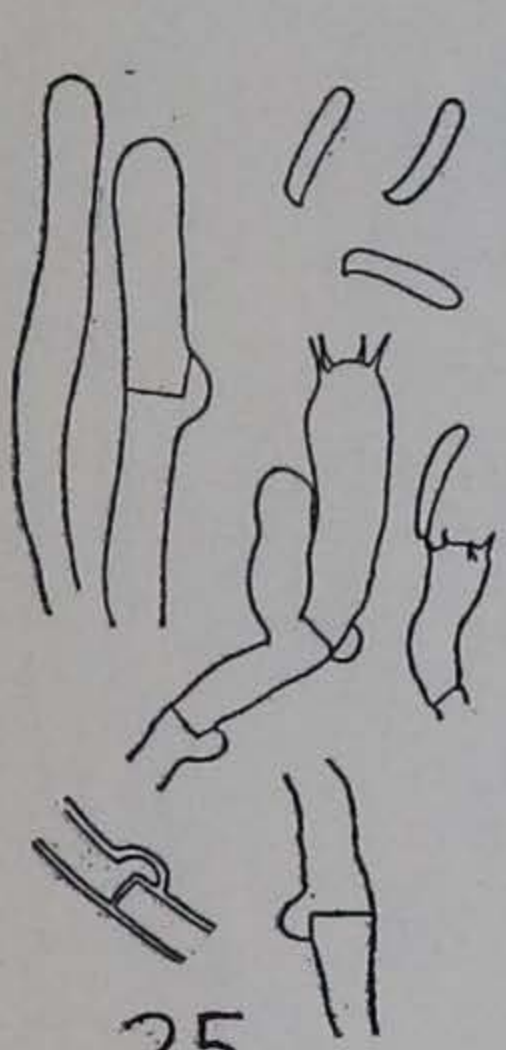

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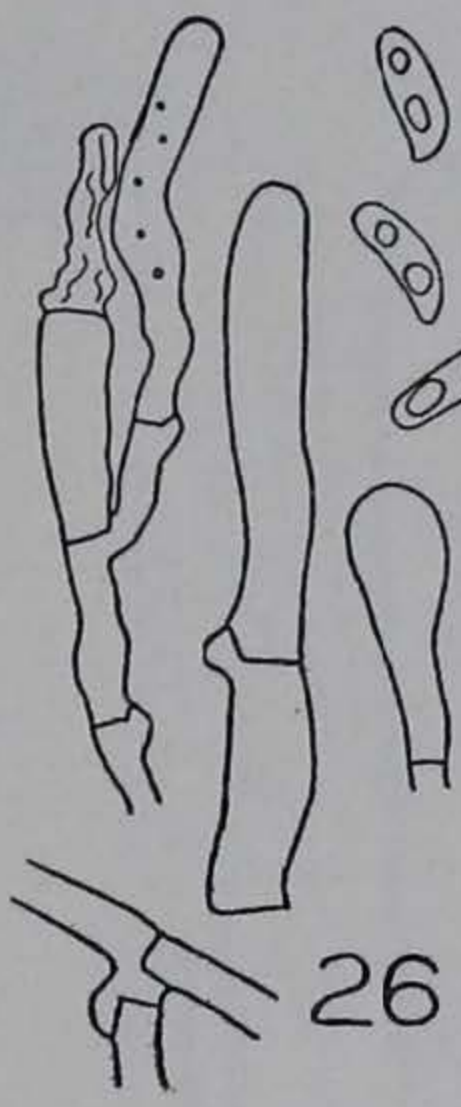

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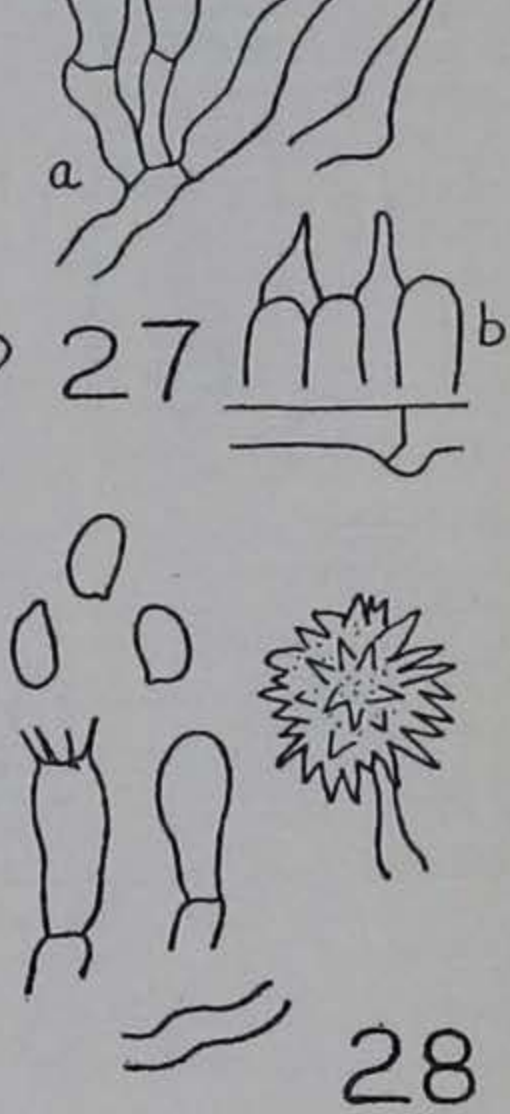

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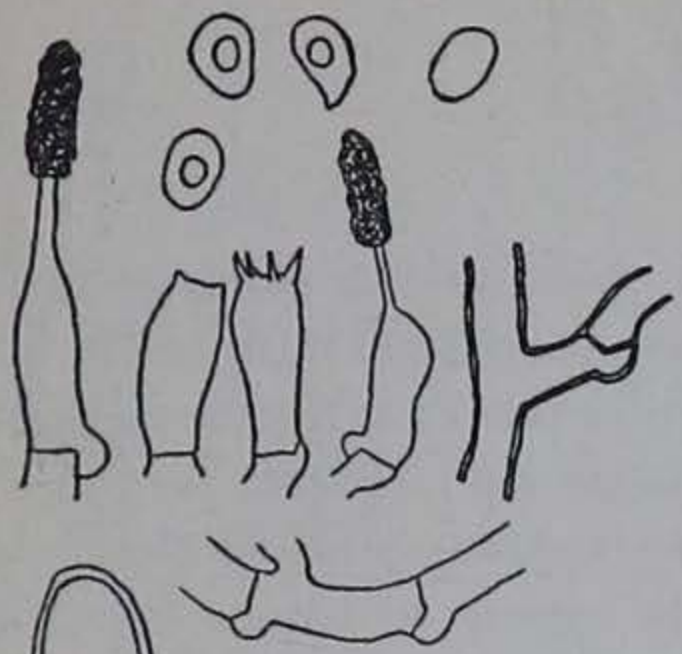
PLATE V. 29. *Odontia arguta*, terminally incrusted cystidia; immature and mature basidia; spores; hyphae from the base of spine. 30. *Odontia livida*, strongly incrusted cystidia as projecting from the apex of spine; spores; basidia; hyphae from the base of spine. 31. *Odontia crustula*, agglutinated and slightly incrusted cystidia as projecting from the apex of spine; basidium; spores; hyphae from the base of spine. 32. *Odontia fusco-atra*, strongly incrusted cystidium from apex of spine; smooth cystidium from side of spine; basidium; spores; hyphae from the base of spine. 33. *Odontia uda*, incrusted cystidia from the apex of spine; immature and mature basidia; spores; hyphae from the base of spine. 34. *Odontia Barba-Jovis*, elongated, thick-walled cystidium from the apex of a spine; immature and mature basidia; spores; thick-walled hyphae from the base of spine.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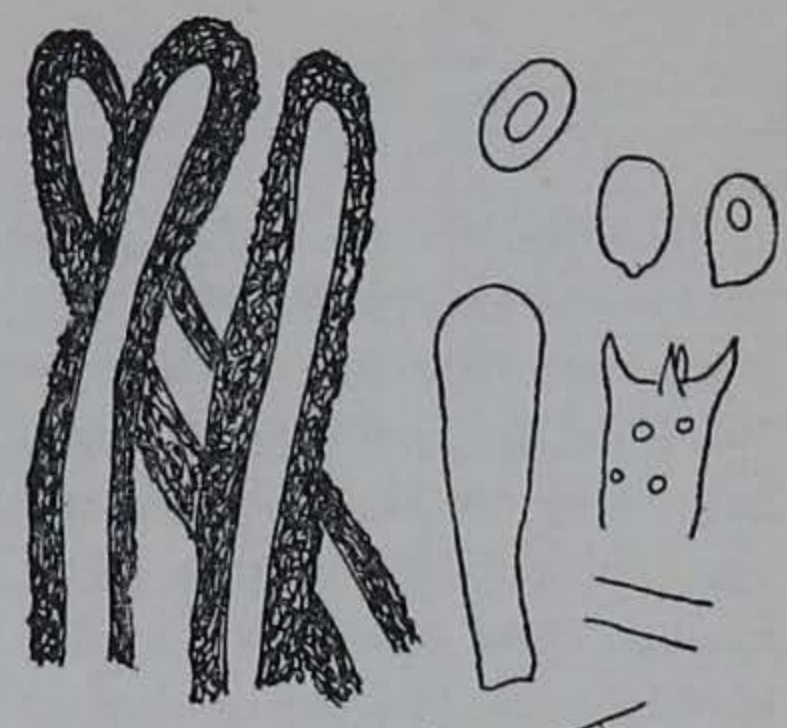
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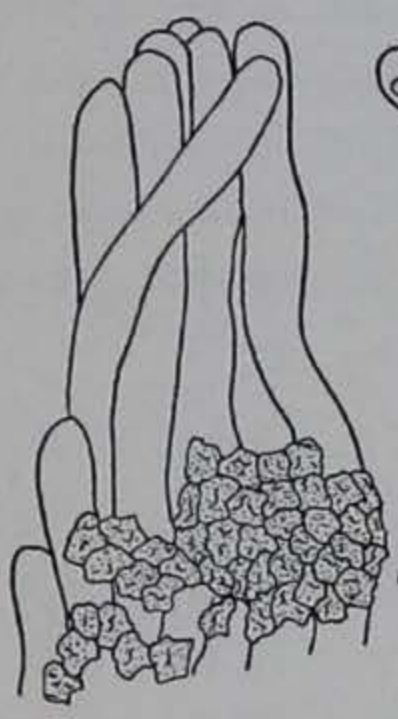
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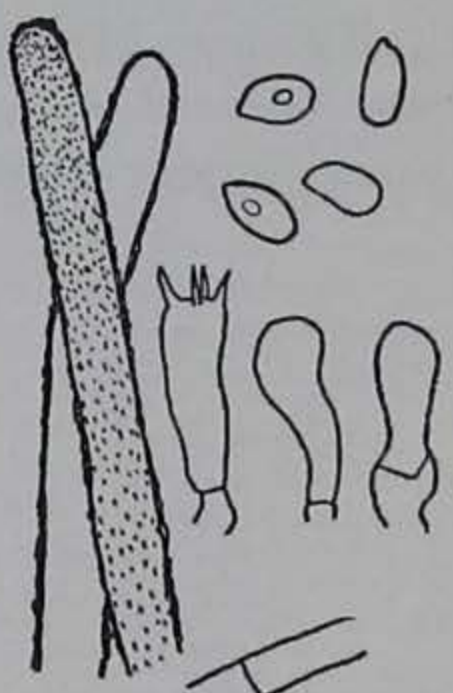


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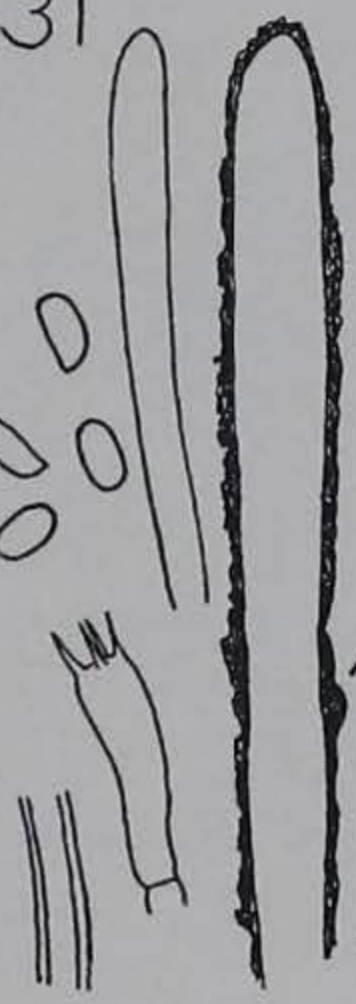
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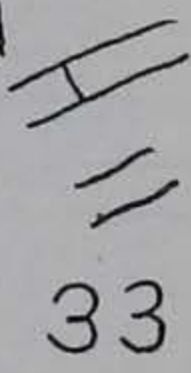
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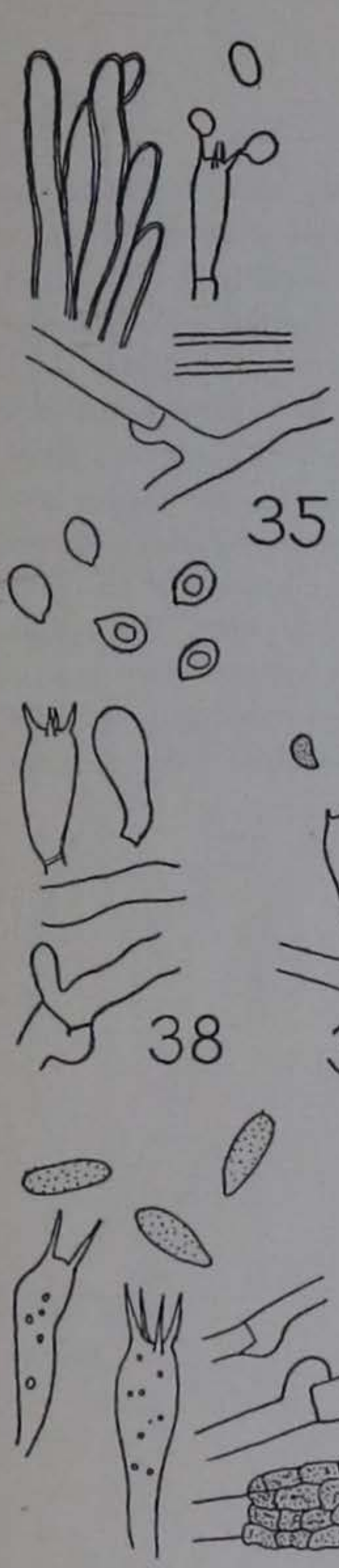
PLATE VI. 35. *Odontia stipata*, thick-walled, elongate cystidia projecting from apex of spine; spores; basidium; thin-walled hypha from base of spine; thick-walled hypha from axial region of spine. 36. *Odontia spathulata*, cystidia; basidium; spores; hypha from base of spine. 37. *Mycoacia macrodon*, spores; basidia; gloeocystidium; thick-walled hypha from axial region of spine; thin-walled hyphae from base of spine. 38. *Mycoacia setosa*, immature and mature basidia; spores; hyphae from base of spine. 39. *Mycoacia stenodon*, basidium; spores; hyphae from base of spine. 40. *Mycoacia fragilissima*, basidium; spores; thin-walled hypha from base of spine; thick-walled and finely incrusted hyphae from rhizomorphic strand. 41. *Mycoacia alboviride*, slightly guttulate basidia; spores; hyphae from base of spine. 42. *Mycoacia Himantia*, guttulate basidia; spores; hypha from base of spine.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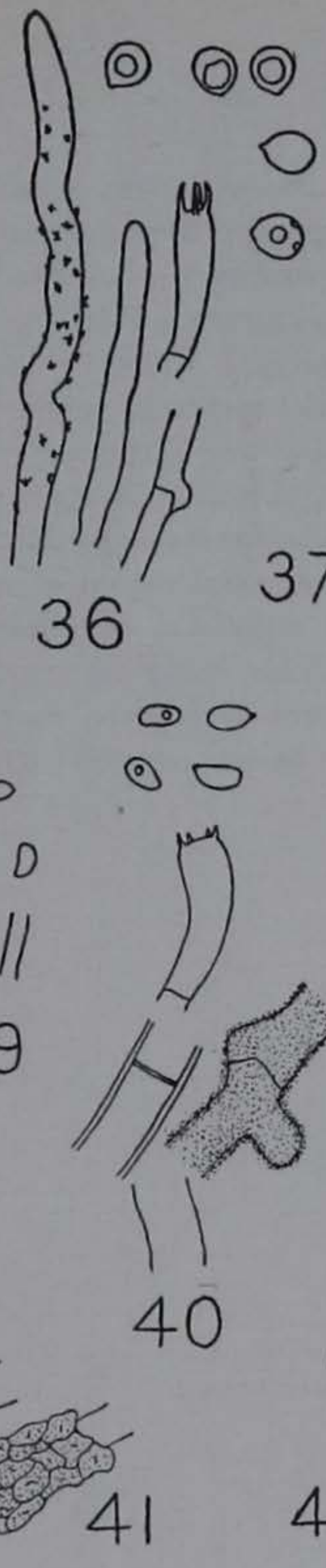
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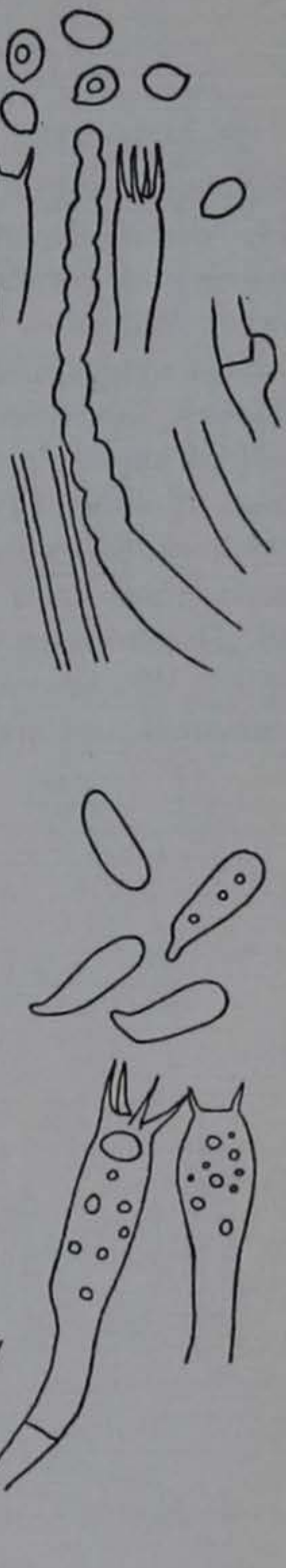
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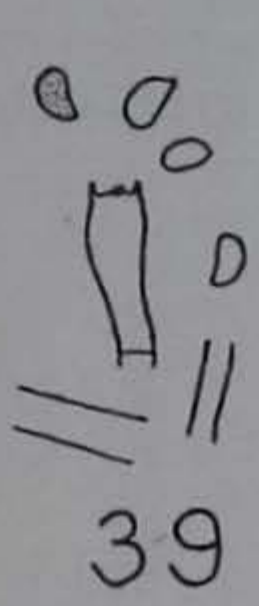
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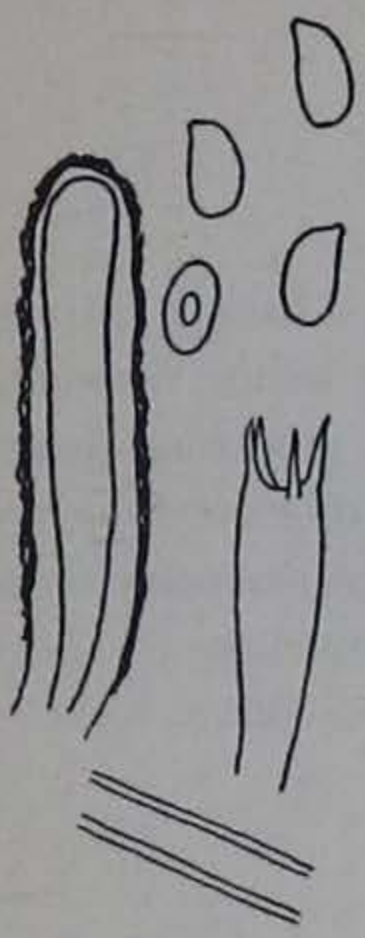
PLATE VII. 43. *Steccherinum setulosum*, the incrusted cystidium; basidium; spores; hypha from axial region of spine. 44. *Steccherinum ochraceum*, incrusted cystidium; basidium; spores; thick-walled hypha from axial region of spine. 45. *Steccherinum laeticolor*, basidium; spores; incrusted cystidium; thick-walled hypha from axial region of spine. 46. *Steccherinum septentrionale*, incrusted, fusiform cystidium; basidium; spores; thick-walled hypha from axial region of spine; thin-walled hypha from base of spine. 47. *Steccherinum pulcherrimum*, basidia; spores; thick-walled hypha from axial region of spine; hyphae with clamp connections from the mycelium of pileus just below the spines. 48. *Steccherinum adustum*, basidium; spores; hyphae from base of spine. 49. *Steccherinum rawakense*, incrusted fusiform cystidia; immature and mature basidia; spores; hyphae from base of spine.



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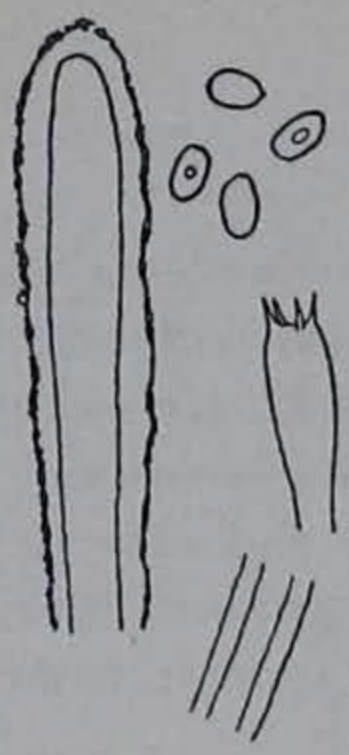

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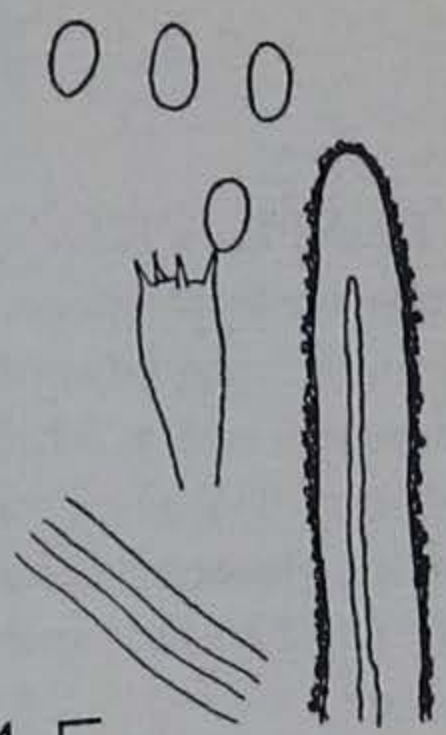

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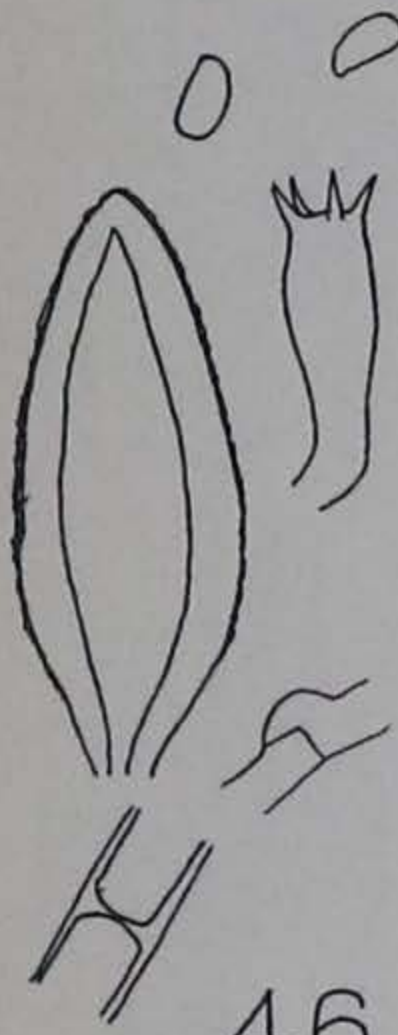

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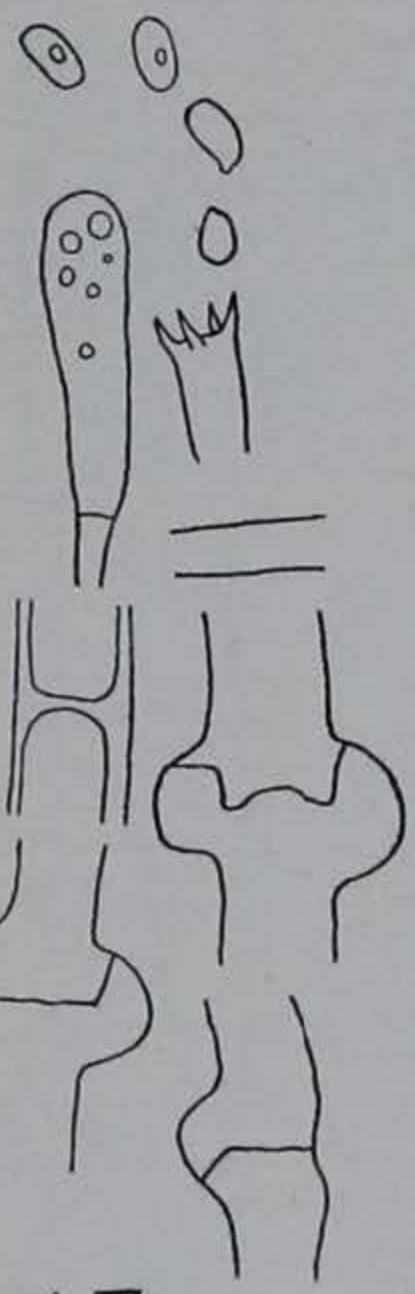

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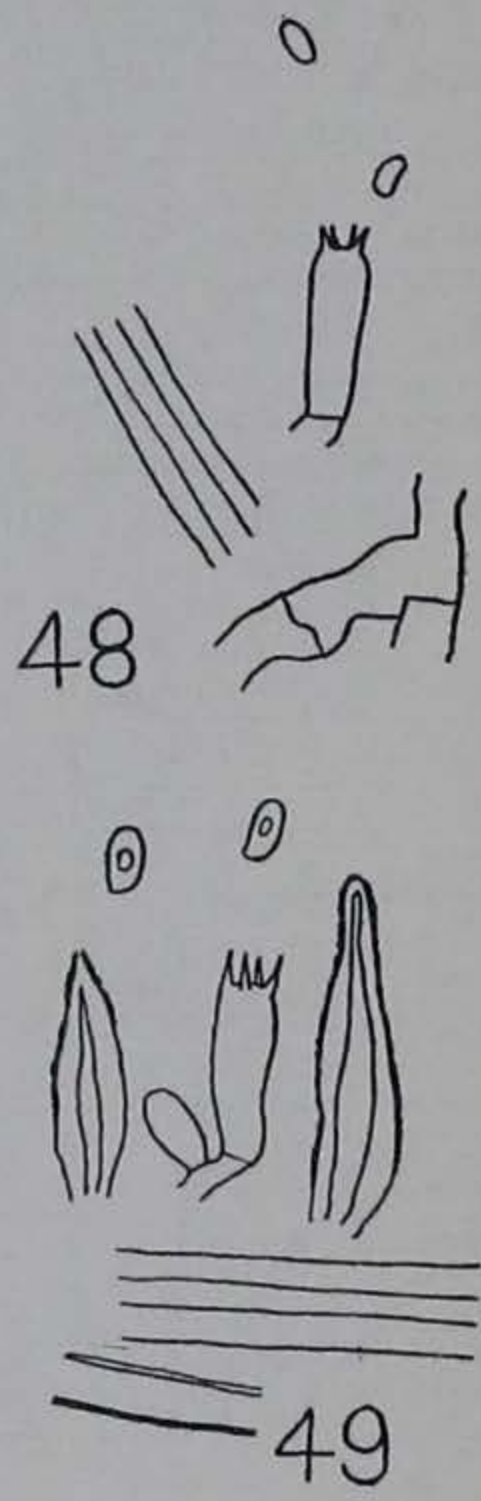

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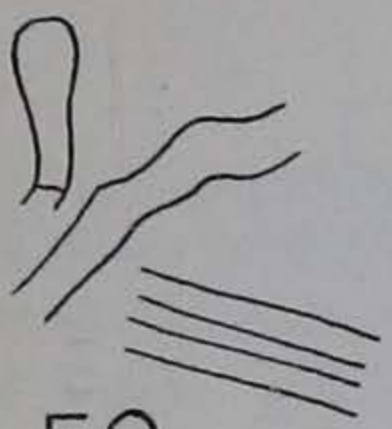
PLATE VIII. 50. *Steccherinum pusillum*, basidium; hyphae from base of spine. 51. *Auriscalpium vulgare*, basidium; spores; hyphae from base of spine. 52. *Hericium erinaceus*, gloeocystidium; spores; basidia. 53. *Hericium lacinatum*, basidium; spores; gloeocystidium; hyphae from base and axis of spine. 54. *Hericium coralloides*, gloeocystidium; spores; basidium; hyphae from base of spine. 55. *Dentinum repandum*, spores; basidium; hypha from base of spine.



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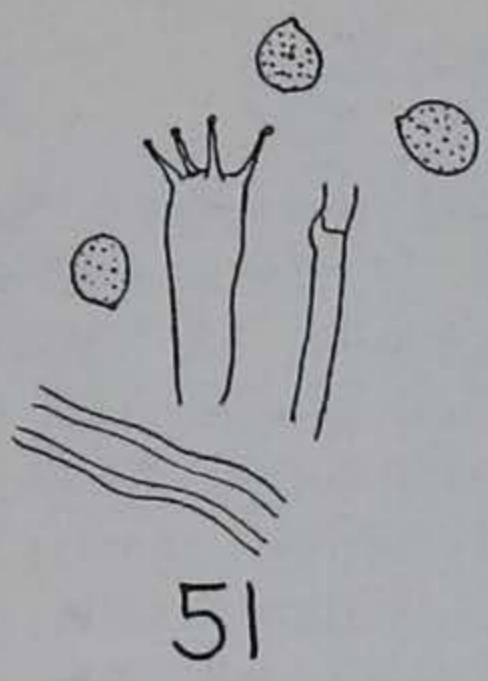

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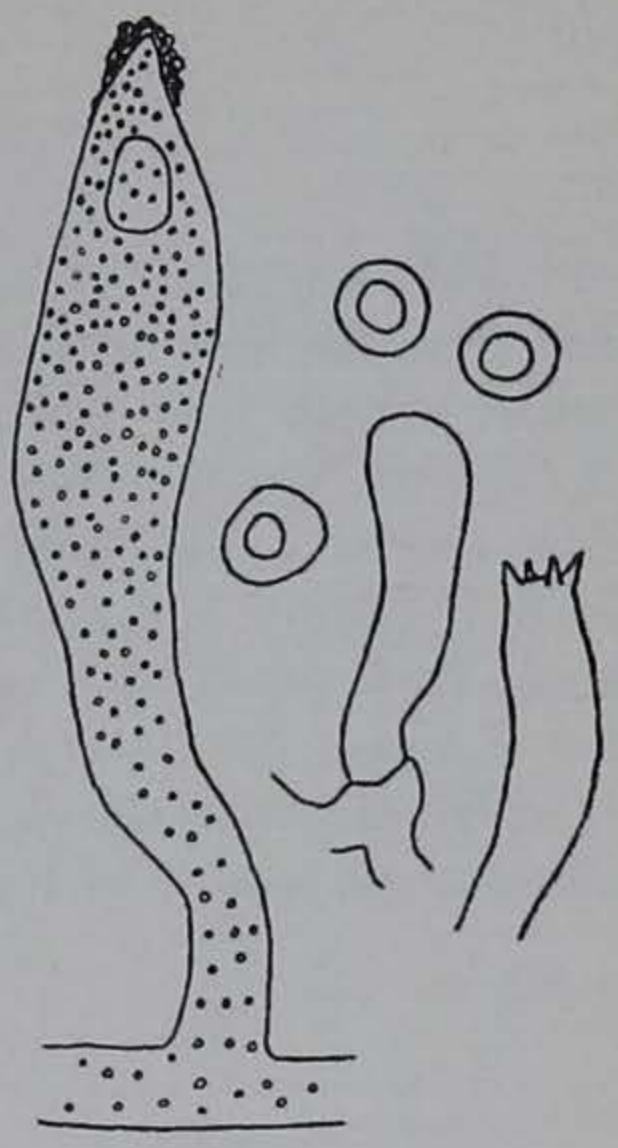

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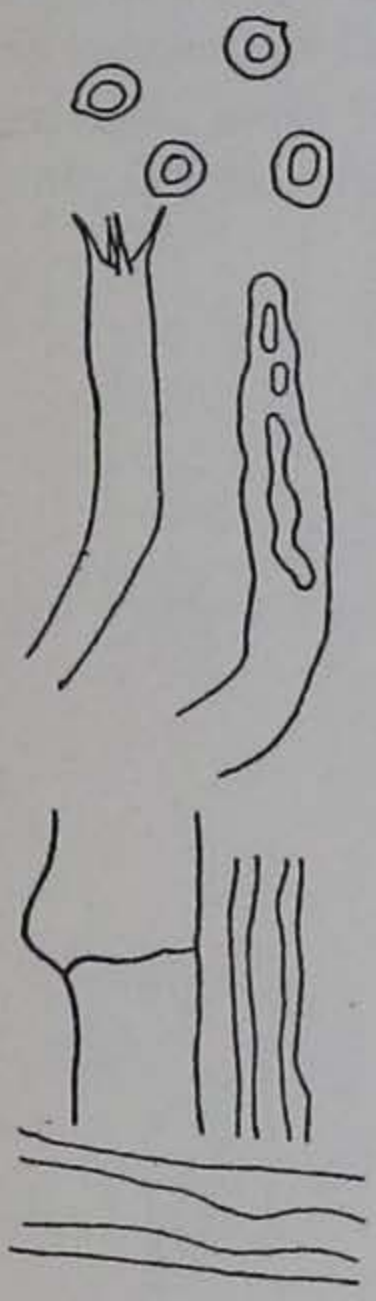

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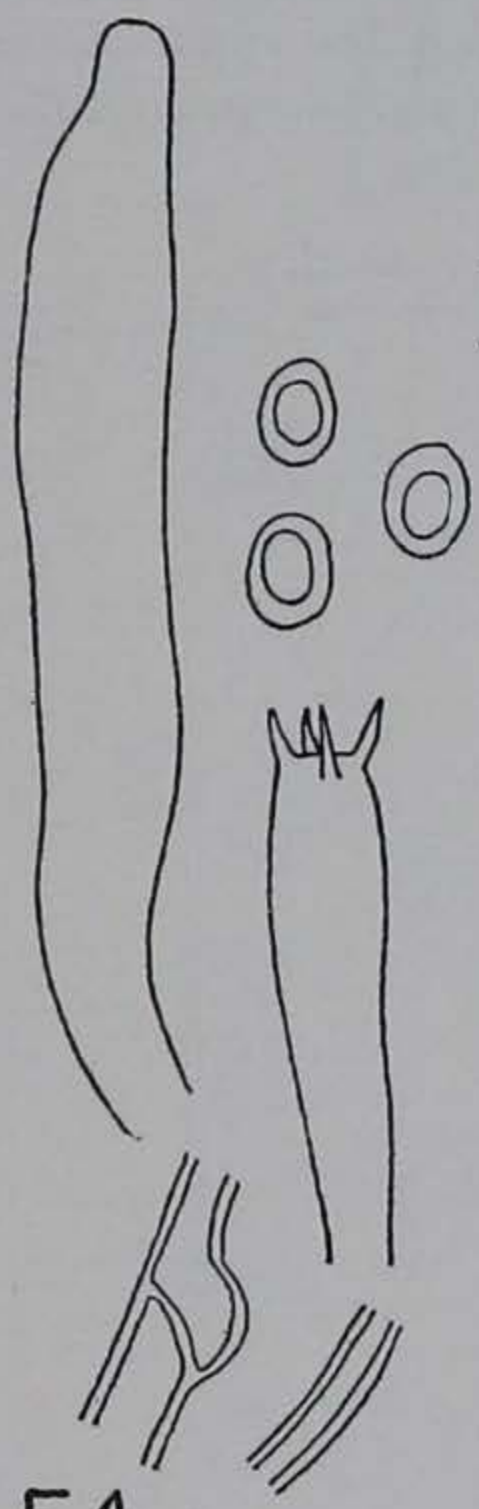

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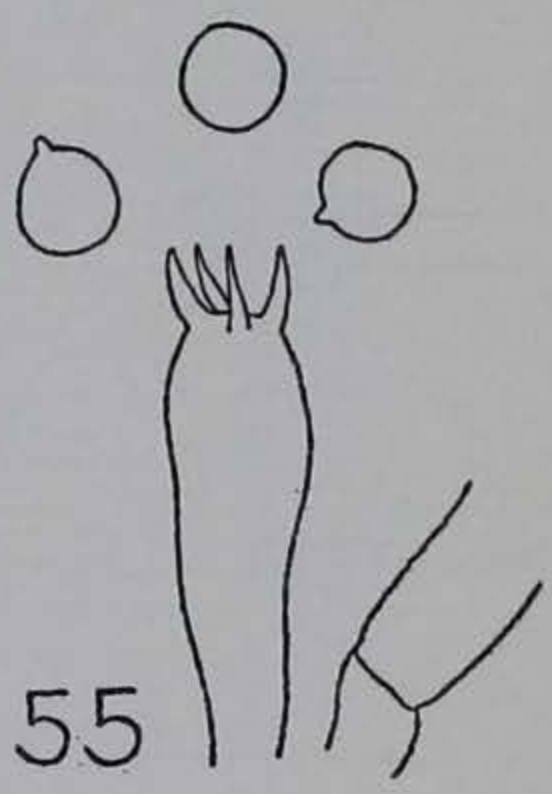

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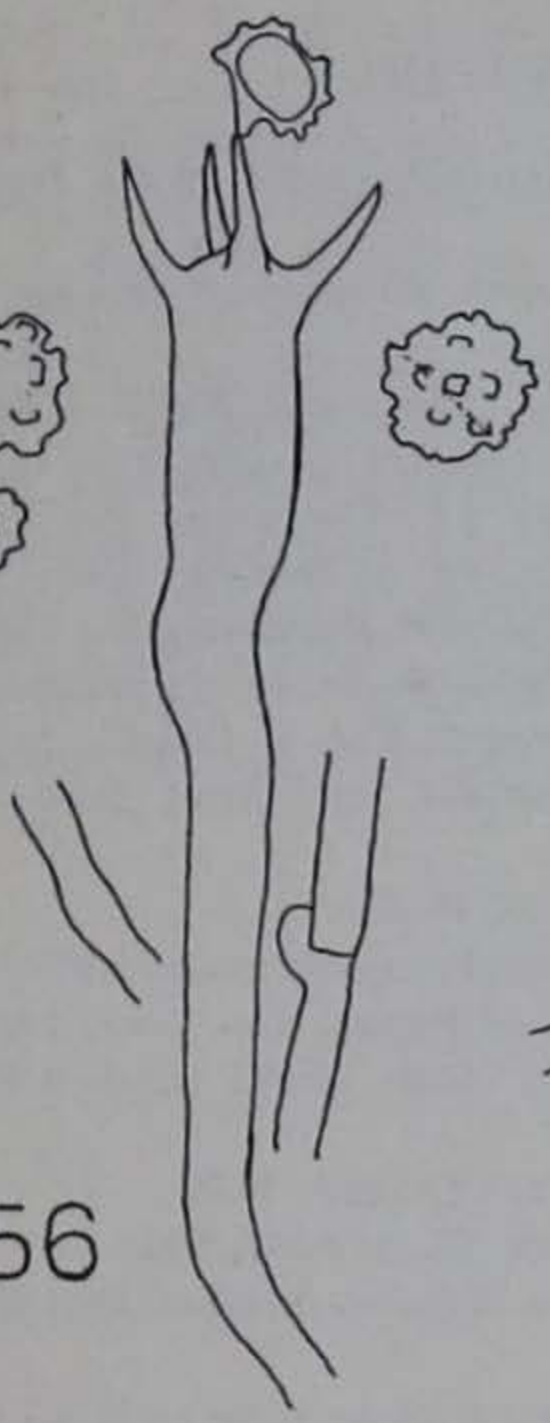
PLATE IX. 56. *Caldesiella ferruginosa,* basidium; spores; hyphae from the base of spine. 57. *Hydnum Underwoodii,* basidium; spores; hyphae from base of spine. 58. *Calodon alboniger*, basidium; spores; hyphae from base of spine. 59. *Calodon amicus*, basidia; spores; hypha from axial region of spine. 60. *Calodon velutinus*; immature and mature basidia; spores; hypha from base of spine. 61. *Calodon zonatus*, immature basidia; spores; hyphae from base of spine. 62. *Calodon zonatus*, transverse section through center of fructification showing decurrent character of teeth, relatively homogeneous texture of fructification and the thinness of the pileus.



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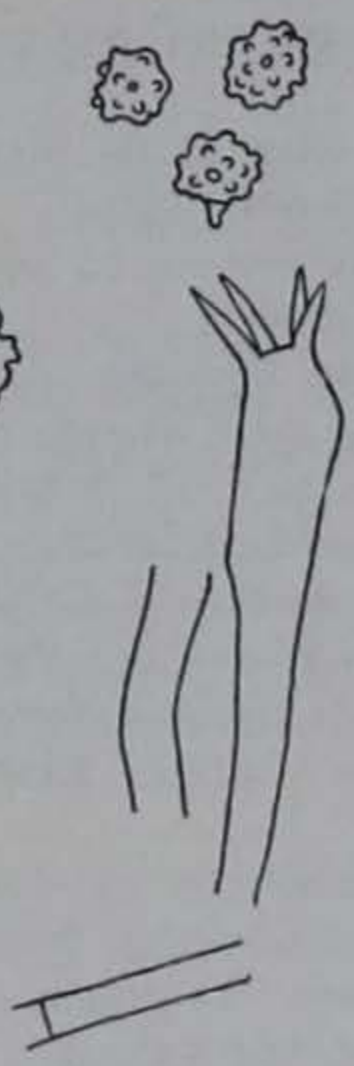

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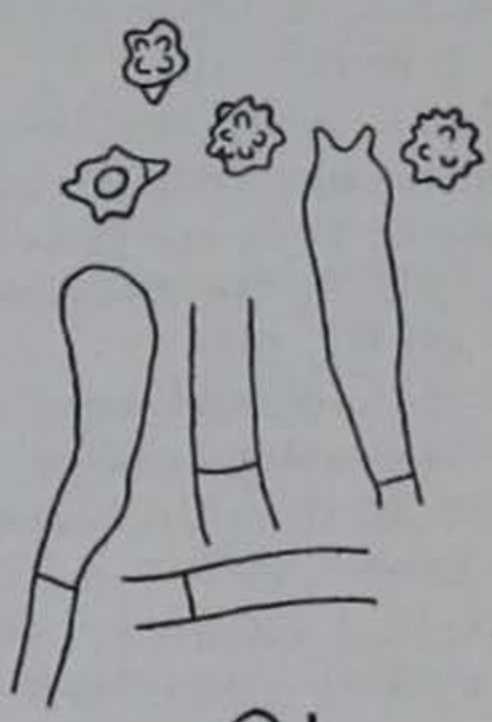

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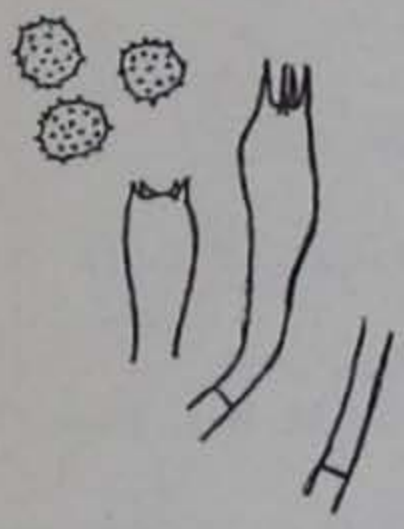

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