Proceedings of the Iowa Academy of Science

Volume 63 | Annual Issue Article 23

1956

On Lentodium squamulosum

G. W. Martin
State University of Iowa

On Lentodium squamulosum

By G. W. Martin

The genus *Lentodium,* with its single species *L. squamulosum,* was established by Morgan (1895) to accommodate a fungus which had then been known for half a century. It was sent to Berkeley from Ohio by Lea in 1845 or earlier; Berkeley commented on it in that year (1845, p. 302) in the following terms: "**Lentinus tigrinus,* Fr. A most remarkable state of this species has been found by Mr. Lea (n. 245) in which the gills have anastomosed, until the whole pileus and gills have become a hard, solid mass. At first sight it has quite the appearance of a new genus; but I am convinced that it is merely a very curious state of our European species." In Lea's catalogue (1849, p. 56), there is a similar, but briefer comment. Later, Berkeley (1860, p. 59) again refers to it: "In some cases [referring to agaries] the pileus, though developed, is never perfected, as in a curious form of *Lentinus tigrinus* not uncommon in the United States, where the whole forms a firm mass, suggesting, with its intricate abortive gills, some new genus, rather than that to which it really belongs."

In describing his new genus, Morgan recognized its affinity with *Lentinus tigrinus,* but stressed the fact that it was a constant and distinctive fungus, abundant in the area in southwestern Ohio where he collected, and where he had never encountered *Lentinus tigrinus.* There are no specimens in the Morgan collection at the State University of Iowa, but Morgan's description and illustrations are clear and leave no doubt of the identity of what he described.

Hennings (1897) listed *Lentodium* at the end of his treatment of the polypores as an incompletely known genus and suggested that its relationships were with the Polyporaceae rather than with the Agaricaceae. Patouillard (1900) placed *Lentodium* among the hymenomycete genera based on teratological forms and, since he was unable to find any evidence of fungal attack, suggested it was the effect of attack by parasitic animals.

Lyman (1907) published a very complete and fully illustrated account of *Lentodium.* He grew the species from spores in pure culture. His description of the fructification is in essential agreement with that of Morgan, although much more detailed. He found hymenial layers present, composed of clavate, sterigmate, 4-spored basidia bearing typical basidiospores 5-6 × 2.5-3.5μ and also noted the production of conidia during early developmental stages. He recognized the resemblance of the species to certain gasteromycetes, but regarded this as superficial. He objected to

calling the pseudotissue covering the lower surface a membrane, pointing out that it originates from the trama. He does not mention the tendency toward radial splitting noted by Morgan, but the fissures shown in his fig. 127 represent this tendency. I have found this feature rather commonly and some suggestion of it may be seen in the lower surface of the pileus illustrated (Fig. 2). Lyman concluded that the genus is constant and clearly defined and that it occupies an isolated position between the Agaricaceae and the Polyporaceae.

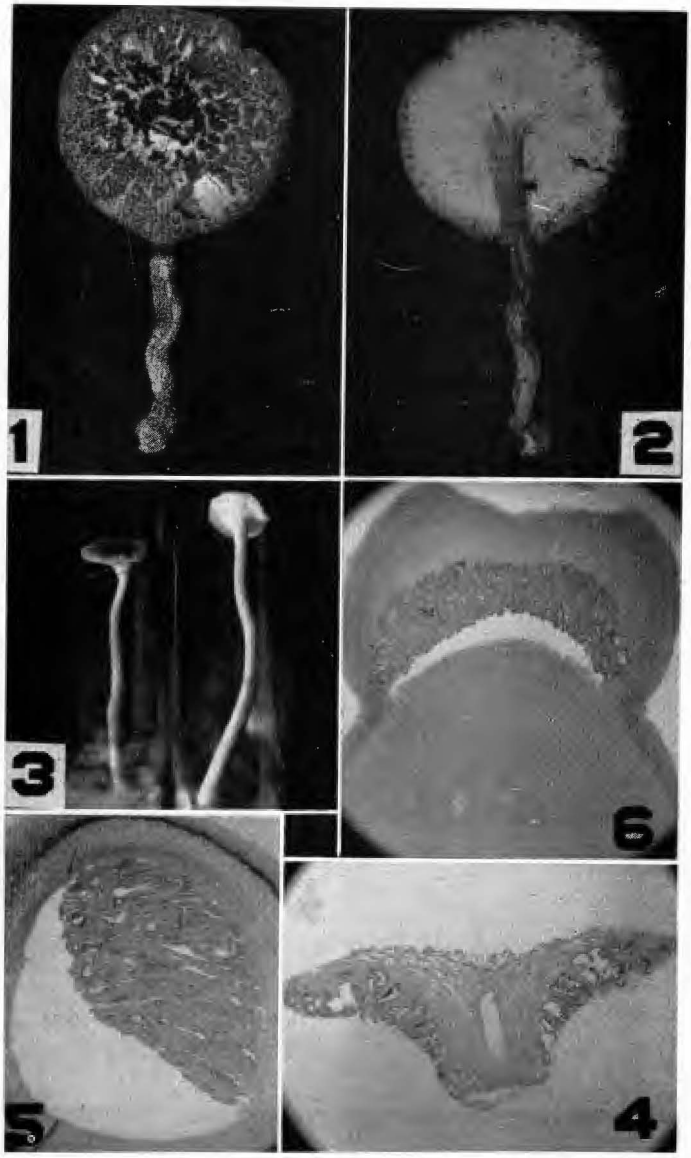
Peck (1909, p. 44), in a paper published after Lyman's but obviously written without knowledge of it, reported that *Lentodium squamulosum* and *Lentinus tigrinus* are sometimes found growing on the same log, with the obvious inference that they might be produced from the same mycelium. He suggested that the "abnormal" form developed spores directly from the hymenial hyphae "without the intervention of basidia."

Earle (1909) used *Lentodium* as the generic name for a group of species segregated from *Lentinus* to include L. *tigrinus* and what he regarded as related species, on the assumption that *Lentodium* Morgan was based on *Lentinus tigrinus,* although an aberrant phase. Earle made this very clear, as his statement will demonstrate: "This generic name is selected with some hesitation, as it was first applied to an abnormality, but there is none other available." Murrill (1911) accepted the name on this basis and in his treatment of the group in North American Flora (1915) merely continued such usage. It is clear, therefore, that Singer's opinion (1949, p. 273) that Murrill's use of the name applies primarily to the "abnormal" form is based on a misunderstanding.

Kauffman (1918, p. 52) confirmed Peck's report that *Lentinus tigrinus* and *Lentodium squamulosum* may occur on the same log. He said: "In the light of Lyman's researches, this form must be considered a regular variation [of *Lentinus tigrinus*] whose tramal hyphae may produce basidia and spores without the development of true gills."

Singer (1949, pp. 273-274) includes *Lentinus tigrinus* and allied species in the section *Criniti* of *Panus* and reports that the carpophores of the *Lentodium* form he had studied were always sterile. He must have had immature or overmature specimens, for I have had no difficulty in finding hymenium, with basidia and basidiospores as described by Lyman. Singer refers to *Lentodium* as a mutation, which is certainly preferable to calling it an abnormality.

Lentodium squamulosum (Figs. 1, 2) is extremely common in eastern Iowa, particularly on fallen willow and soft maple logs in river bottoms. *Lentinus tigrinus,* on the other hand, is extremely rare; I recall collecting it but once in over three decades, in October, 1923. The specimen is in the herbarium of the State Uni-



Figs. 1-4. *Lentodium squamulosum*. 1. Upper surface of dried and flattened basidiocarp, × 1. 2. Lower surface of same. 3. Basidiocarps developed in pure culture, 30 days on oat agar in test-tubes. 4. Median section through pileus of basidiocarp from culture, showing hymenial chambers formed by anastomosing gills, × 8.

Fig. 5. *Podaxis pistillaris*. Portion of glebal cavity, median section, × 8. From preparation by Dr. T. W. Brasfield.

Fig. 6. *Endoptychum agaricoides*. Tangential section of glebal cavity, × 8. From preparation by Dr. T. W. Brasfield.

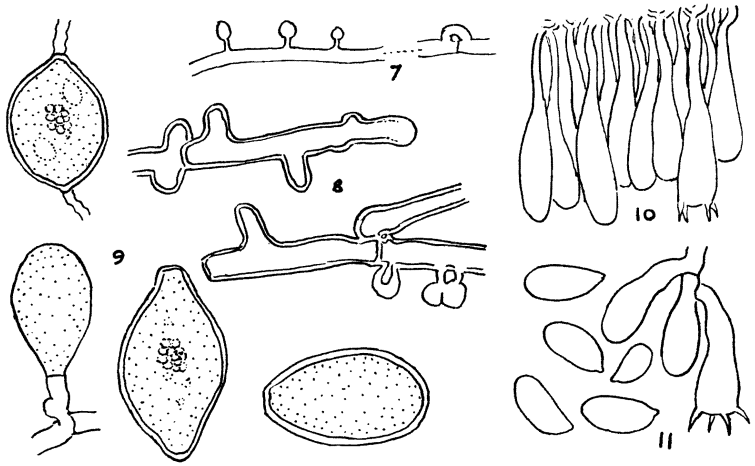
versity with the notation: "From same log upon which *Lentinum* has been collected earlier in the season." Gardner (1948), it is true, records *Lentinum tigrinum* as common, but her report refers to the *Lentodium* form. The beetle larvae which are the pests of herbaria frequently chew off the veil in dried specimens, exposing the contorted gills, and even in old and dry specimens collected in the field, the gills are sometimes more or less exposed by the disappearance of part of the veil. This presumably permits dissemination of the spores much as in *Endoptychum,* where the pileus pulls away from the stalk after the spores are matured, but in fresh, mature, but not over-mature specimens, the gills are completely covered.

Lentodium is readily grown in culture and usually fruits in 3 to 4 weeks on oat agar. I have cultured it from tissue a number of times and have secured many fructifications (Fig. 3). Except for their small size when grown in test-tubes, these are, as a rule, entirely characteristic of the *Lentodium,* but occasionally vary in ways described by Lyman as "abnormalities." Such irregular developments are common in Basidiomycetes grown in culture and are less abundant in *Lentodium* than in most of the similar forms I have cultured. Except when they are very old, I have never known the basidiocarps to have gills visible from the exterior. They do contain folded, contorted and more or less anastomosing gills (Fig. 4), lined with an hymenium of perfectly typical basidia, each bearing four basidiospores (Figs. 10, 11). Morgan gave the spore size as 5-6 $\times$ 3μ; Lyman, as noted, extended the width to 3.5μ. I find them somewhat more variable, 4.4-7.3 $\times$ 2.5-3.2μ. Kauffman (1918, p. 52) gives the spore size of *Lentinus tigrinus* as 6-7 $\times$ 3-3.5μ; Kühner and Romagnesi (1953, p. 71) 7-8 or 8-12 $\times$ 3-3.5μ.

In old cultures, brown mycelial areas appear, often forming an irregular ring 2 to 3 cm from the original inoculation. These are composed of greatly thickened hyphae, clamp-bearing, but with the clamps often distorted and obscured, and with numerous short branches, especially near the tips (Fig. 8). Some of these branches appear to round off and are possibly detached. The chlamydospores (Fig. 9) are formed either terminally or intercalarily and are thick-walled, brownish, and mostly 11-18 $\times$ 6-10μ. After their formation, the hyphae in which they are produced shrivel and eventually disappear. Lyman reported and illustrated conidia, which he found at the margin of the young pileus. I have not seen these but have found similar conidia, although very sparingly, in culture (Fig. 7), always borne on slender hyphae with clamp-connections.

In section, the hymenial region (Fig. 4) appears very much like that of *Podaxis* and *Endoptychum* (Figs. 5, 6). These two genera

are among the better-known of the gasteromycete-like fungi which show clear evidence of close relationship with agaries. As early as 1907, Conard concluded that *Secotium agaricoides* (Czern.) Hollós (i.e. *Endoptychum agaricoides* Czern.) is an agaric, which reaches reproductive maturity in the button stage. It has, however, reached the gasteromycete stage in its basidia, which produce basidiospores axially, rather than asymmetrically, on rather long sterigmata. Gäumann (1926) included the Secotiaceae in the Agaricales and listed the Podaxaceae as a family supplementary to that order. Heim (1931) showed that *Galera Besseyi* Peck displayed modifications which approached the structure of *Podaxis*. He concluded that it was a gasteromycete derived from *Galera*, just as *Gyrophragmium, Elasmomyces* and *Battarraea* may be thought of as derived



Figs. 7-11. *Lentodium squamulosum*. 7. Conidia, on hypha with clamp-connection. 8. Thick-walled hypha from brown area of culture. 9. Four chlamydospores, one immature. 10. Portion of hymenium, from paraffin section. 11. Cluster of basidia, from crushed mount, and five basidiospores. All × 1500.

from other agarics. Velenovský (1930) had independently, and slightly earlier, come to a similar conclusion and had erected the genus *Galeropsis* for a related species. Brasfield (1937) compared *Secotium agaricoides* with *Podaxis pistillaris* and found that the two species were essentially similar in their manner of development, both showing early stages similar to those of agarics. *Podaxis* has gone further in the gasteromycete direction in that the basidiospores are sessile or borne axially on very short stalks. (Heim, 1932). Moreau (1954) includes a number of such genera in the agaric families to which they seem to be related. Malençon (1955) presents a table showing possible relationships of these agaricine gasteromycetes with various families of boletes and agarics, making a

sharp distinction btween the "décadents" series Exogastrineae (9 families, including the Secotiaceae and the Podaxaceae) and the ascending series of Endogastrineae (8 families, including the Lycoperdaceae, Sclerodermataceae and Nidulariaceae, with the Tulostomataceae as an additional side line). It is clear that the classical conception of the gasteromycetes as a phyletic unit is undergoing drastic revision.

In 1951, Singer described a new genus, *Thaxterogaster,* with two species, which he regarded as an additional link between the agarics and the gasteromycetes. He takes this occasion to repeat and amplify his view that fungi of this sort, which appear intermediate between agarics and gasteromycetes, are evidence of the derivation of the former from the latter, rather than the reverse. Singer's arguments are answered by Heim (1951), convincingly, in my opinion.

It seems clear that the case of *Lentodium squamulosum* must be considered in the light of the strong evidence of relationship existing between various agarics and the many gasteromycete-like genera represented by those which have been mentioned. It is not a teratological form, still less an abnormality or monstrosity, but a common, easily recognized, constant entity, with a wide distribution, extending at least from Massachusetts to Iowa. In southwestern Ohio and in eastern Iowa it is much more abundant than *Lentinus tigrinus,* from which it is supposed, with good reason, to have been derived. As such, it is an excellent example of an agaric showing a distinct approach to a gasteromycete habit. The genus should be maintained, in Morgan's sense. It should not, however, be removed from the family to which it is clearly related, in this instance the Agaricaceae in the traditional sense; the Tricholomataceae, if the newer classification is used. Its existence furnishes an addition to the arguments favoring the derivation of the Exogastrineae, in Malençon's sense, from the agarics, as favored by Heim, rather than the reverse, as maintained by Singer.

Literature Cited

Berkeley, M. J. 1845. Decades of Fungi. VIII to X. Australian and North American Fungi. Lond. Jour. Bot. 4: 298-315.

———— 1860. Outlines of British fungology. London.

Brasfield, T. W. 1937. The morphology of *Podaxis pistillaris.* Univ. Iowa Stud. Nat. Hist. 17: 199-211.

Conard, H. S. 1907. The structure and development of *Secotium agaricoides.* Mycologia 7: 94-103.

Earle, F. S. 1909. The genera of North American gill fungi. Bull. N. Y. Bot. Gard. 4: 373-451.

Gardner, Phyllis D. 1948. An annotated checklist of the Homobasidiomycetes of Iowa. Proc. Iowa Acad. [for 1947] 54: 67-97.

Gäumann, Ernst. 1926. Vergleichende Morphologie der Pilze. Jena.

Heim, R. 1931. Sur les liens phylétiques entre les agarics ochrosporés et certain gastéromycètes. Comtes rend. Acad. Sci. 192: 291-294.

———— 1932. La formation des spores chez les *Podaxon*. Comptes rend. Acad. Sci. 194: 1182-1184.

———— 1951. Sur les *Secotium* de Nouvelle-Zélande et la phylogénie de ce genre. Rev. de Mycologie 16: 129-153.

Hennings, P. 1897. Hymenomycetineae. In, Engler and Prantl, Naturl. Pflanzenf. 1 Abt. 1: 105-276.

Kauffman, C. H. 1918. The Agaricaceae of Michigan. Mich. Geol. & Biol. Surv. Pub. 26.

Kühner, R. and H. Romagnesi. 1953. Flore analytique des champignons supérieurs. Paris.

Lea, T. G. 1849. A catalogue of plants, native and naturalized, collected in the vicinity of Cincinnati, Ohio, during the years 1834-1844. Philadelphia. [Fungi by Berkeley].

Lyman, G. R. 1907. Culture studies on polymorphism of Hymenomycetes. Proc. Boston Soc. Nat. Hist. 33: 125-209.

Malençon, G. 1955. Le développement du *Torrendia pulchella* Bres. et son importance morphogénétique. Rev. de Mycologie 20: 81-130.

Moreau, Fernand. 1954. Les champignons, vol. 2. Paris.

Morgan, A. P. 1895. New North American fungi. Jour. Cincinnati Soc. Nat. Hist. 18: 36-45.

Murrill, W. A. 1911. The Agaricaceae of tropical North America—I. Mycologia 3: 22-36.

———— 1915. Agaricaceae. Part 4. North American Flora 9: 201-296.

Patouillard, N. 1900. Essai taxonomique sur les familles et les genres des Hyménomycètes. Lons-le-Saunier.

Peck, C. H. 1909. Report of the State Botanist 1908. N. Y. State Mus. Bull. 131.

Singer, R. 1949. The Agaricales in modern taxonomy. Lilloa 22: 1-832.

———— 1951. *Thaxterogaster*—a new link between Gasteromycetes and Agaricales. Mycologia 43: 215-228.

Velenovský, J. 1930. *Galeropsis* g. n. Mykologia (Prague) 7: 105-106.

Department of Botany
State University of Iowa
Iowa City, Iowa