

# Different species of *Lactarius* grouped together based on spore morphology



Jessica Silva\* and David Lewis‡

\*Eastfield College, DCCCD, Mesquite, TX ‡S.M. Tracy Herbarium Texas A&M University, College Station, TX

## Abstract

Basidiospores (spores) of *Lactarius* function as the fundamental source in reproduction; therefore, microscopic research of the spores themselves serves a great purpose in the classification of the fungi. The purpose of this experiment is to analyze 30 specimens of *Lactarius* and to group them based on spore morphology. Four groups of spores will be characterized based on shape and surface ornamentation and the different species of *Lactarius* will be placed in these groups. The results indicated, as expected, that spores vary in size, shape, and ornamentation. Overall, it was possible to characterize four groups of spores and place 28 out of the 30 specimens of *Lactarius* into these groups. The similarities and differences in spore morphology of all specimens were analyzed and observed. Further research needs to be conducted on the maturity stages of spores.

## Introduction

Among Basidiomycetes, size, shape, and ornamentation of the spores vary from species to species and are generally used in the classification process. It is necessary to correlate the macroscopic and microscopic characters in classifying different species (1). In order to distinguish between specimens, the spores will be observed under the scanning electron microscope (SEM). Will the shape and size of the spores be sufficient to differentiate between the different species? Is it possible to group the different species of *Lactarius* based on the characteristics of the spores? Words such as elliptical, broadly elliptical, round, roundish, nearly round, and oval are used to describe the shape of these spores. Ornamental, reticulate, reticulate-warted, and spiny are used to describe the texture or the outer appearance. The sizes of the spores are generally measured in micrometers.

## Materials and Methods

All samples were identified and labeled with the help of David Lewis a Southeast Texas Mycologist, along with the help of various field guides. The information placed on each label included the specimen identification number, genus, species, habitat, site, location, county, state, date, and any additional notes regarding the measurements, color, and smell of the mushroom itself. At the end of every collection all data was entered into David Price Lewis's (DPL) Database. For this experiment, 30 specimens of the genus *Lactarius* were used and among them were 20 different species. In order to view the spores, the specimens were placed under a dissecting microscope and small portions of the gills were cut using a small razor blade. The specimens were held using small flat forceps and then transferred onto the stubs for the SEM. The surface of the gills was slightly scratched in order to release the spores onto the stub itself. This allowed for photos of the spores to be taken when attached and detached from the gills. This process was executed using sterile techniques in order to avoid contamination of spores from one sample to the other. Spores were viewed on the SEM Hitachi S-3400. At least three spores of each specimen were measured and descriptions of each sample were collected and analyzed.

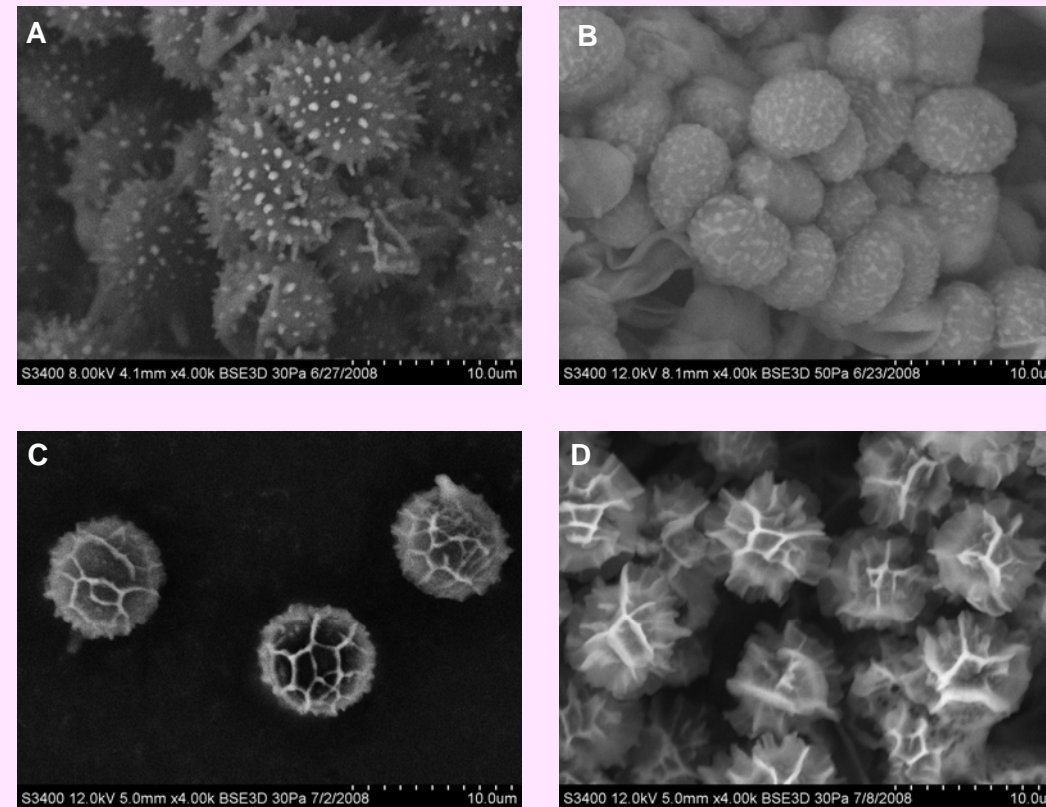


Figure 1: A. Spores of the mushroom *Lactarius deceptiveus* (6998). Example of Group 1. B. Spores of the mushroom *Lactarius section albatii*. Example of Group 2. C. Spores of the mushroom *Lactarius gerardii*. Example of Group 3. D. Spores of the mushroom *Lactarius subvernalis var. cokeri*. Example of Group 4. \* All spores are seen at ~4000x under SEM. Scale bar = 10  $\mu$ m.

## Results

Four groups of spores (Figure 1:A-D) were found and *Lactarius* specimens were grouped based on spore morphology (Table 1). Group 1 is categorized as elliptical – spiny spores, Group 2 as elliptical – warted spores, Group 3 as Elliptical – reticulated spores, and Group 4 as Roundish – rugose spores. Both *L. deceptiveus* (6998) and *L. cf deceptiveus* (8033) were placed in Group 1 and there was no noticeable pattern in size. *L. caeruleitinctus* (7212), *L. caeruleitinctus* (6071), and *L. caeruleitinctus* (6874) are all different specimens of the same species but were placed in separate groups. *L. caeruleitinctus* (7212) was placed in Group 2, whereas, *L. caeruleitinctus* (6071) and *L. caeruleitinctus* (6874) were placed in Group 3. The spores of *L. caeruleitinctus* (7212) are smaller and differ in shape and surface ornamentation. All specimens of *L. subvernalis*, *L. fumosus*, *L. fuliginellus*, and *L. subplinthogalus* (*L. plinthogalus*) were found to be grouped together and have very little variation in spore morphology among the different specimens.



Group 1	
Shape:	Elliptical
Surface Ornamentation:	Spiny
Range:	6.0-10.5 x 4.0-8.0 $\mu$ m
Specimens:	<i>L. cf deceptiveus</i> (8033) <i>L. deceptiveus</i> (6998)

Group 2	
Shape:	Elliptical
	Elliptical - roundish
	Elliptical - oblong
Surface Ornamentation:	Isolated warts
	Warted with spines
	Tuberculate - warted
Range:	5.0-11.0 x 4.0-7.5 $\mu$ m
Specimens:	<i>L. caeruleitinctus</i> (7212) <i>L. section albatii</i> <i>L. section piperatus</i> <i>L. subpalustris</i> <i>L. subvellerus</i> v. <i>subvellerus</i>

Group 3	
Shape:	Elliptical
	Elliptical - roundish
Surface Ornamentation:	Reticulate
	Reticulate - warted
Range:	6.5-10.0 x 5.0-9.0 $\mu$ m
Specimens:	<i>L. caeruleitinctus</i> (6071) <i>L. caeruleitinctus</i> (6874) <i>L. croceus</i> <i>L. gerardii</i> <i>L. indigo</i> var. <i>diminutivus</i>

Group 4	
Shape:	Roundish (spherical)
Surface Ornamentation:	Rugose or wrinkled
Range:	6.0-10.5 x 5.0-10.0 $\mu$ m
Specimens:	<i>L. eburneus</i> variant <i>L. fuliginellus</i> (6984) <i>L. fuliginellus</i> (7513) <i>L. fumosus</i> (7004) <i>L. fumosus</i> (7024) <i>L. fumosus</i> (7025) <i>L. imperceptus</i> <i>L. lignyotus</i> var. <i>canadensis</i> <i>L. plinthogalus</i> group <i>L. subplinthogalus</i> (6882) <i>L. subplinthogalus</i> (7920) <i>L. subvernalis</i> var. <i>cokeri</i> <i>L. subvernalis</i> (6974) <i>L. subvernalis</i> (7028) <i>L. subvernalis</i> (8187) <i>L. subvernalis</i> (8561)

Table 1: *Lactarius* species grouped based on spore morphology. Shown are 28 specimens of *Lactarius* placed into four groups based solely on spore morphology. Due to lack of information specimens *L. badiopallescens* and *L. agglutinatus* were not grouped.

## Discussion

Generally, the averages of most specimens were within the ranges as reported by many mushroom field guides. However, it was difficult to find a published range for *L. caeruleitinctus*, *L. agglutinatus*, and *L. badiopallescens*. *L. cf deceptiveus* (cf – identification not confirmed) was placed in Group 1 along with *L. deceptiveus*. Both specimens have the same shape and ornamentation therefore it is possible to say that the identification for *L. cf deceptiveus* is confirmed.

Overall, it was possible to characterize four groups of spores and place 28 out of the 30 specimens of *Lactarius* into these groups. The similarities and differences in spore morphology of all specimens were analyzed and observed.

## Literature Cited

- Hesler, L.R. and Smith, Alexander H. (1962) Studies on *Lactarius* – III the North American Species of *Section Plinthogali*. *Brittonia*: 14.4: 369-440.

## Acknowledgments

I would like to thank my mentor, David Lewis, for his guidance and support. Many thanks to: Mr. Jeff Hughes for helping in the field; and Dr. Carl Knight and Dr. Jennifer Baggett for their advice and constant support. Eastfield College Project Pathways Summer Institute is supported by the National Science Foundation Science Talent Expansion Program Grant # DUE-0525536, the Dallas County Community College District, the National Park Service, and the Big Thicket Association.