

# Comparative Analysis of Morphology and Taxonomy of Different *Pleurotus* Species Found In Jharkhand

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**Abstract:** *Pleurotus* commonly known as 'Oyster mushroom' is a highly delicate and nutritious variety of mushroom grown and consumed as a food item in Jharkhand. The morphology, taxonomy and nutritional contents depend heavily on the quality of substrate and also on climatic conditions. The most important species of *Pleurotus* which grow naturally in abundant quantity are *Pleurotus ostreatus*, *Pleurotus florida*, *Pleurotus flabellatus* and *Pleurotus sajor caju*. In the present study, the morphological features of the *Pleurotus* species of Jharkhand has been observed and compared very deeply in order to establish their taxonomic position, especially in view of the fact that their morphology, nutritional content depend heavily on substrate composition and environmental factors, leading to misidentification. It also provides confusion with regard to their synonyms. The three species *Pleurotus ostreatus*, *Pleurotus florida* and *Pleurotus flabellatus* show many similar features and hence belong to the same genus but the species *Pleurotus sajor caju* show many dissimilar external features and must be considered under another suitable genus.

**Key Words:** *Pleurotus* spp., Morphology, Taxonomy, Identification, Veil, Spore print.

## INTRODUCTION

Mushrooms have been attracting attention of mankind since ancient times and use of mushroom as food is as old as human civilization. There are references on the medicinal uses of mushrooms in the medical treaties of ancient India, "Sumhita of Acharya Charak" dating back to 300 to 500 B.C. It is believed that the "Soma" of Rigveda was a preparation of mushroom called *Amanita muscaria*<sup>01</sup>.

There are different views in regard to the origin of the term "mushroom". In Latin 'fungo' means to flourish. It was a term which was used to refer to mushroom and to excrescences from the ground or from trees. In Greek the term "mushroom", was derived from the word "sphonggos" or "sphoggos" which meant "sponge" and referred to the sponge-like structure of the species. *Pleurotus* (Fries) Kummer are popularly known as oyster mushrooms. They are Basidiomycetes and regarded as a so-called speciality mushrooms by mushroom growers. This distinction has been made of a varied group of mushrooms on grounds of the general availability and level of commercialization<sup>02, 03, and 04</sup>. Other members include *Lentinus edodes* (Berk.) Sing. (Shiitake), *Volvariella volvacea* (Bull.ex Fr.) Sing. (Straw mushroom), *Flammulina velutipes* Sing. (Winter mushroom), *Pholiota nameko* (T. Ito) S. Ito ("nameko" or viscid mushroom) and *Tremella fuciformis* Berk. (Jelly fungus or silver ear)<sup>05</sup>.

In the natural environment *Pleurotus* spp. are lignocellulosic fungi occurring on tree trunks in subtropical and temperate forests and causing white rot of wood. This name stems from the appearance of the wood after the degradation of the lignin and cellulose from the cell walls in wood<sup>06</sup>. Fruit bodies of *Pleurotus* species have more or less one-sided fleshy caps with decurrent gills. They are slightly funnel-shaped and usually excentrically stalked, grown in clusters<sup>07</sup>. New species in this genus are still being discovered<sup>08, 09</sup>. But not all *Pleurotus* species are useful as commercial crops. Their brittle sporophores, excessive sporulation and rather unusual taste render some of them unpopular as consumer mushrooms<sup>10</sup>. In recent years, various aspects of *Pleurotus* cultivation have received a lot of attention, mostly with the commercial development of the fungus in mind. However, some of the investigations are not aimed at the food basket of the consumer. The suitability of *Pleurotus* in medicine, bioconversion, bioremediation and biopulping is being investigated as well<sup>11</sup>.

## I. RESEARCH METHODOLOGY

Morphological parameter like color of mushroom, its shape, length of stipe, diameter of pileus, surface of pileus, thickness of stipe, texture of the stipe and pileus, position of the stipe etc. were studied.

Anatomical preparation was made to study the basidiospores. For spore study, pilei were moisten by adding a few drop of potassium hydroxide solution and sections were prepared. The section was subsequently stained with methylene blue and its color was examined. Length, diameter, shape and size and texture of basidiospore were recorded.

## II. RESULTS AND DISCUSSION

**Morphological studies** revealed that each of the *Pleurotus* species had features which are as follows:

### a) *Pleurotus ostreatus*:

**Pileus:** Cap 5-15 cm to 5-25 cm broad, fan-shaped, broadly convex to sometimes nearly plane at maturity, flat and little bit depressed at the center; kidney-shaped to fan-shaped at maturity, somewhat greasy when young and fresh; pileus is smooth and bright white in color. The margin enrolled when young, later on it became wavy. When young, never lined or lobed to wavy. Surface is smooth with the anise odor.

**Lamellae:** Gills decurrent and white in color, veil is absent; gills running down the stipe; very close; whitish or with a gray tinge, whitish in age.

**Stipe:** Stipe almost absent; when present, is short and thick, 0.5-3.0 cm long, 0.5-2.0 cm thick; eccentric or lateral with dense white hairs at the base.

**Spores:** 8-10.5 x 3-3.5 µm; smooth; cylindrical to narrowly kidney-shaped, elliptical in shape.

**Spore print:** white.

b) *Pleurotus florida*:

**Pileus:** Cap 4-12 cm to 5-24 cm broad, fan-shaped, broadly convex to sometimes nearly plane at maturity, flat or somewhat depressed at the center, very thick showing high content of flesh, little bit greasy when young and fresh; smooth, pale brown to dark brown; margin enrolled when young, later wavy, never lined or lobed to wavy, especially when young; white to grayish white with the anise odor.

**Lamellae:** Gills decurrent and white in color, veil absent; gills run down the stipe and very close; whitish or with a gray tinge, sometimes yellowish.

**Stipe:** Stipe often absent, when present, short and thick; 0.5-2.5 cm long, 0.5-2.0 cm thick, eccentric or lateral with dense white hairs at the base.

**Spores:** Spores 7-8 x 3.5-4 µm; smooth; cylindrical to narrowly kidney-shaped, elliptical basidiospores.

**Spore print:** gray.

c) *Pleurotus flabellatus*:

**Pileus:** Cap 3-11 cm to 3-20 cm broad, fan-shaped, broadly convex and almost plane at maturity; becoming flat, kidney-shaped to fan-shaped; greasy when young and fresh, the margin of the disc enrolled towards the stipe, becomes wavy later on. Never lined or lobed to wavy, especially when young; surface smooth, white to light pinkish. Flesh white, odor anise like.

**Lamellae:** Gills decurrent and white in color, veil absent, lamellae almost attached to the stipe; whitish or with a gray tinge.

**Stipe:** Stipe often absent, when present, short and thick; 0.5-2.5 cm long, 0.5-2.0 cm thick; eccentric or lateral in position with dense white hairs at the base.

**Spores:** 7-8 × 3-4 µm; smooth; cylindrical to narrowly kidney-shaped, almost elliptical in shape.

**Spore print:** light pink.

d) *Pleurotus sajor caju*:

**Pileus:** Quite different from the other three species, cap 3-8 cm to 4-16 cm broad, fan-shaped, but not flat; in spite of being broadly convex, curled completely and enrolled inwardly i.e. towards the top of the disc. Cap is flat when young but with gradual development and at maturity, the flatness gives way to inwardly folded disc of the fruiting body; top of the disc very smooth with greasiness; fleshy with the completely exposed gills, white to yellowish with the same odor of anise.

**Lamellae:** Gills decurrent and white in color, gills run down the stipe and continuous with the stipe, color whitish or generally creamish when fresh; with time, changes to light yellow.

**Stipe:** Stipe present in a mature fruiting body, oldest and tallest in one cluster but short and thick; 0.5-3.0 cm long, 0.5-2.0 cm thick, eccentric or lateral with dense white hairs at the base.

**Spores:** 6-8 × 3-4 µm; smooth; cylindrical to narrowly kidney-shaped, elliptical.

**Spore print:** light yellow.

The above studies helped to formulate a table, shown below, with the help of which the four species of *Pleurotus* can be easily identified:

Features	<i>Pleurotus ostreatus</i>	<i>Pleurotus florida</i>	<i>Pleurotus flabellatus</i>	<i>Pleurotus sajor caju</i>
Colour	White	White to gray	Cream to pinkish	Cream to light yellow
Pileus: size	5-15 cm to 5-25 cm broad	4-12 cm to 5-24 cm broad	3-11 cm to 3-20 cm broad	3-8 cm to 4-16 cm broad
Pileus: shape	Flat- fan, margin enrolled towards the gill	Flat- fan, margin enrolled towards the gill	Flat- fan, margin enrolled towards the gill	Leaf/petal, complete disc is curled & enrolled inwardly
Lamellae	Gills decurrent, veil is absent	Gills decurrent, veil is absent	Gills decurrent, veil is absent	Gills decurrent, veil is present
Stipe/Stalk	0.5-3 cm long 0.5-2 cm thick	0.5-2.5 cm long 0.5-2 cm thick	0.5-2.5 cm long 0.5-2 cm thick	0.5-3 cm long 0.5-1.5 cm thick
Spores	8-9 × 3.5-4.5 µm, smooth & elliptical	7-8 × 3.5-4 µm smooth & elliptical	7-8 × 3-4 µm smooth & elliptical	6-8 × 3-4 µm smooth & elliptical

Spore print	White	Gray	Light pink	Light yellow
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**Table: Comparative morphological analysis of the four studied species of *Pleurotus* Mushroom**

In the present work, attempts were also made to provide farmers/ laymen with a simple key to identify different species of *Pleurotus*.

**Key for identification** of the *Pleurotus* species cultivated in Jharkhand:

Identification	
Key for identification	Classification
<ul style="list-style-type: none"> <li>Production of basidiospores &amp; absence of motile cells takes place.</li> <li>Exogenous production of basidiospores on club-shaped basidia takes place. Sexual organs are absent.</li> </ul>	<b>Class- Basidiomycetes</b>
<ul style="list-style-type: none"> <li>Gills are completely exposed.</li> <li>The basidia are arranged to form a definite hymeneal layer exposed on gills.</li> </ul>	<b>Order- Agaricales</b>
<ul style="list-style-type: none"> <li>The fruit bodies grow in clusters with Oyster shell-shaped pileus / disc.</li> <li>Thallus body is monomitic i.e. the body is made up of single hyphal skeleton.</li> </ul>	<b>Family- Pleurotaceae</b>
<ul style="list-style-type: none"> <li>The oldest fruit body of a cluster is the tallest one.</li> <li>Position of the stipe is lateral.</li> </ul>	<b>Genus- <i>Pleurotus</i></b>
<ul style="list-style-type: none"> <li>Veil is absent.</li> <li>Fruit body monomitic.</li> <li>Pileus is smooth and bright white in color.</li> <li>Sporophores ostreate, surface smooth, margin incurved, stipe short, sometimes hairy at base.</li> <li>Spore size is <math>8-9 \times 3.5-4.5 \mu\text{m}</math>.</li> </ul>	<b><i>Pleurotus ostreatus</i></b>
<ul style="list-style-type: none"> <li>Pileus is fleshy, white to gray in color.</li> <li>Spore size is smaller than <i>Pleurotus ostreatus</i></li> </ul>	<b><i>Pleurotus florida</i></b>
<ul style="list-style-type: none"> <li>Pileus is pinkish in color.</li> <li>Sporophores sponge like.</li> <li>Fruiting body is comparatively stiff, short, fan shaped.</li> </ul>	<b><i>Pleurotus flabellatus</i></b>
<ul style="list-style-type: none"> <li>Veil is present.</li> <li>Body is dimitic or trimitic.</li> <li>Sporophores usually grow solitary or in groups, often lobed and folded at maturity giving a coralloid appearance.</li> <li>White to gray or dull brown in colour, surface smooth.</li> <li>Margin irregular and incurved.</li> </ul>	<b><i>Pleurotus sajor caju</i></b>

This is now concluded that the three species namely *Pleurotus ostreatus*, *Pleurotus florida* and *Pleurotus flabellatus* show the similar morphological features and hence kept in the same genus *Pleurotus* but the species sajor caju is misunderstood in this genus and must be kept in the genus *Lentinus*. Hence, *Pleurotus sajor caju* must be considered as *Lentinus sajor caju*.

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