



## *Calvatia pyriformis* : A New Record in Indonesia

<sup>1</sup>Rudy Hermawan, <sup>2</sup>Ivan Permana Putra

<sup>1</sup>Alumni Program Studi Mikrobiologi, Departemen Biologi, Institut Pertanian Bogor, Indonesia

<sup>2</sup>Divisi Mikologi, Departemen Biologi, Institut Pertanian Bogor, Indonesia

[hermawan\\_rudy@apps.ipb.ac.id](mailto:hermawan_rudy@apps.ipb.ac.id), [ivanpermanaputra@apps.ipb.ac.id](mailto:ivanpermanaputra@apps.ipb.ac.id)

### ARTICLE INFO

#### Article History:

Received : 20-09-2018

Revised : 16-11-2018

Accepted : 23-11-2018

Online : 30-11-2018

#### Keywords:

*Calvatia pyriformis*;

Puffball;

Mushroom;

Indonesia



### ABSTRACT

**Abstract:** *Calvatia* has the unique form as puffball mushroom. Currently, it is classified in Basidiomycota and Lycoperdaceae. This research aimed to characterize the *Calvatia* species based on morphological data. Fruiting body of *Calvatia* was found on the grass with single colony as saprobic mushroom. Fruiting body of *Calvatia* was collected, observed, and preserved using Formalin Acetic Alcohol (FAA). The spores are produced internally in a gasterothecium. It is looked like pear-shaped or puffball-shaped, yellow to brownish outside and inside, the granular outer surface, thin layer of exoperidium, and soft texture of fruiting body. Basidiospore is finely globose to ovoid and free of ornament. The capillitium was swollen and septate. The specimen is identified as *Calvatia pyriformis*.

**Abstrak:** *Calvatia* memiliki bentuk unik sebagai jamur bola. Saat ini, *Calvatia* di klasifikasikan ke dalam Basidiomycota dan Lycoperdaceae. Studi ini bertujuan untuk mengkarakterisasi spesies *Calvatia* berdasarkan data morfologi. Tubuh buah *Calvatia* tumbuh di rumput secara soliter sebagai jamur saprob. Tubuh buah jamur dikoleksi, diobservasi, dan dipreservasi dengan menggunakan *Formalin Acetic Alcohol* (FAA). Spora-spora diproduksi secara internal di dalam sebuah gasterothecium. Spesimen ini berbentuk seperti pir atau bola permukaan dan bagian dalamnya berwarna kuning kecoklatan, terdapat alur granular pada permukaannya, lapisan exoperidium tipis, dan teksturnya lembut. Basidiospora berbentuk globose sampai seperti ovoid dan tidak ada ornamentasi. Hifa kapillitium berbentuk membengkak dan ada sekat. Spesimen ini diidentifikasi sebagai *Calvatia pyriformis*.



<https://doi.org/10.31764/justek.vXiY.3737>



This is an open access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license

### A. INTRODUCTION

Mushroom is the term for macroscopic fungi and usually classified in Basidiomycota and Ascomycota. Mushroom has many forms as a unique trait of each genera. The forms including toadstool, coral, puffball, fan, etc. (Brundrett et al., 1996). Having the unique shape, Puffball-shaped mushroom, bear its main character within Basidiomycota group. One of them is *Calvatia*. *Calvatia* was built by Elias Magnus Fries in 1849. In previous, *Calvatia* was classified into Lycoperdales. Then, *Calvatia* is put in Agaricales (Index Fungorum, 2018; Mycobank, 2018). This genus consists 40 species (Kirk et al., 2008). *Calvatia* is also known as epigeous puffball like *Lycoperdon*. *Calvatia* are classified as edible mushroom, as long as in immature condition only (Gray, 1973).

In Indonesia, *Calvatia* species had been recorded as *C. vinosa*, *C. boninensis*, *C. craniiformis*, and *C. Cyathiformis* (Kasuya & Retnowati, 2006), and also *Calvatia*

*excipuliformis* in Sumatera (Noverita et al., 2016). In IPB university, *Calvatia* was found on grassy field in Landscape Arboretum Area. At glance, the mushroom is looked like *C. pyriformis*. The *C. Pyriformis* had been found in India as a new record (Verma et al., 2018). We intend to identify and confirm the position of this *Calvatia* as also this is the first record of *C. pyriformis* in Indonesia. This study aimed to describe one of *Calvatia* species using morphological data.

## B. MATERIALS AND METHODS

The sampling was conducted in June 6<sup>th</sup> 2018 and located in Landscape Arboretum of IPB University. The mushroom was documented and collected. Then, the observation was conducted in the mycology laboratory of Biology Department, Mathematics and Natural Sciences Faculty, IPB University. The morphological characters, such as size, color, shape, and ornamentation of fruiting bodies were observed using Olympus stereo and binocular microscope cs22LED. Fruiting body that was collected was only found for mature fruiting body. The sample was preserved in FAA (Kottapalli et al., 2016).

The genus and species were identified using morphological data. The morphological data of fruiting body was observed and documented to confirm the species identity. The species identification of *Calvatia* followed the identification website (Kuo, 2018) and other journal references (Bates et al., 2009; Bisht et al., 2006; Verma et al., 2018). The decriptio of fresh specimens was following (Brundrett et al., 1996).

## C. RESULTS AND DISSCUSSION

**Specimen description.** Saprobic on the grass and growing solitary. Fruiting body was only found for one mushroom as mature fruiting body. **Sexual morphology:** Fruiting body looks like pear-shaped (Fig 1a). The mature fruiting body was in big size (16 cm). The stem is 8.8 cm in length and 4.7 cm in diam. The immature fruiting body was yellow outside and white to yellowish inside (Fig 1c). The fruiting body was perfectly wrinkled. The surface of fruiting body was granular. It is more or less bald, thin layer, soft and becoming more yellow. The mature fruiting body showed that the basidiospores mass was produced inside the fruiting body looked like orange to brownish dust (Fig 1b). Basidiospore was globose to ovoid without any ornamentation (smooth surface), 3.4-3.5  $\mu\text{m}$  x 3.5-3.7  $\mu\text{m}$  (Fig 1c). In fruiting body, the capillitium was a swollen hifae, septate, rounded to ovale, with 50.4-52.8  $\mu\text{m}$  x 38.1-39.7  $\mu\text{m}$ . **Specimen examined:** Grass field in Landscape Arboretum of IPB University, Rudy Hermawan.

*Calvatia* has puffball-shaped or pear-shaped. It is classified as Basidiomycotina within Agaricales and Lycoperdaceae. Puffball as a mushroom has many types of fruiting body such as, stalked puffball, true puffball, and false puffball (Miller, 1973). The distinguish character of puffball is that the spores are produced internally in a gasterothecium. When the spores become mature, a gleba inside fruiting body will be formed and developed. this part makes every species within puffball species will be unique and difference each other. The basidiocarp (the part of fruiting body) remains closed. Then, when the spores are ready to release outside, an aperture from the upper of fruiting body will be developed and formed. Finally, the spores are release from the basidiocarp. This phenomenon is one of the main characters of puffball mushroom. Simply, it is because clouds of brown or yellow dust-like spores are emitted when the mature fruitbody bursts.

Puffballs have many varieties of sizes, i.e. small, a marble and a basketball. One of the genera is *Calvatia*. In this genus, it is really possible to find a giant puffball mushroom, namely *C. gigantea* (Kuo, 2018). In this study, the fruiting bodies of *Calvatia* was found

in IPB university campus forest. This mushroom has shape characteristic as puffball-shaped or more to pear-shaped. The fruiting bodies was collected only for the mature fruiting body. The mature fruiting body showed the puffball stem. The *Calvatia* has yellow on the surface. The inside of fruiting body showed the yellow to brownish (Fig 1b).

The yellow to brownish (looked like a dust) is characterized of mature basidiospores inside the fruiting body. *Calvatia* is one of puffball mushroom. Puffball is a mushroom that make clouds of brown dust-like spores when the mature fruitbody bursts. Simply, the basidiospores are impacted like Gaestromycetes. The basidiospores are blown away by wind (Ingold, 1965). The big *Calvatia* as *C. gigantea* can produce five trillion basidiospores (Li, 2011). The basidiospore also showed the brownish with globose to ovoid and free of ornamentation (Fig 1c). Other basidiospore of *Calvatia* has ornamentation such as *C. lachnoderma* with echinate ornamentation (Cortez & Alves, 2012), *C. booniana* with weakly punctate ornamentation (Moreno et al., 1998), and *C. fumosa* with verucose ornamentation (Baseia, 2003). The other character is capillitium (Fig 1d). The specimen has the swollen character and septate of the capillitium hyphae. This character is in agreement with Verma et al. (2018). Verma et al. (2018) found *C. pyriformis* with the character of basidiospore was lemon-shaped (ovoid) and the character of capillitium hyphae was swollen and septate. Many of *Calvatia* species can be distinguished using these characters. Therefore, the species of our *Calvatia* belongs to *Calvatiapyriformis*. The matched characters are the color of fruiting body for mature, the shape, the size, the basidiospore and capillitium hyphae.

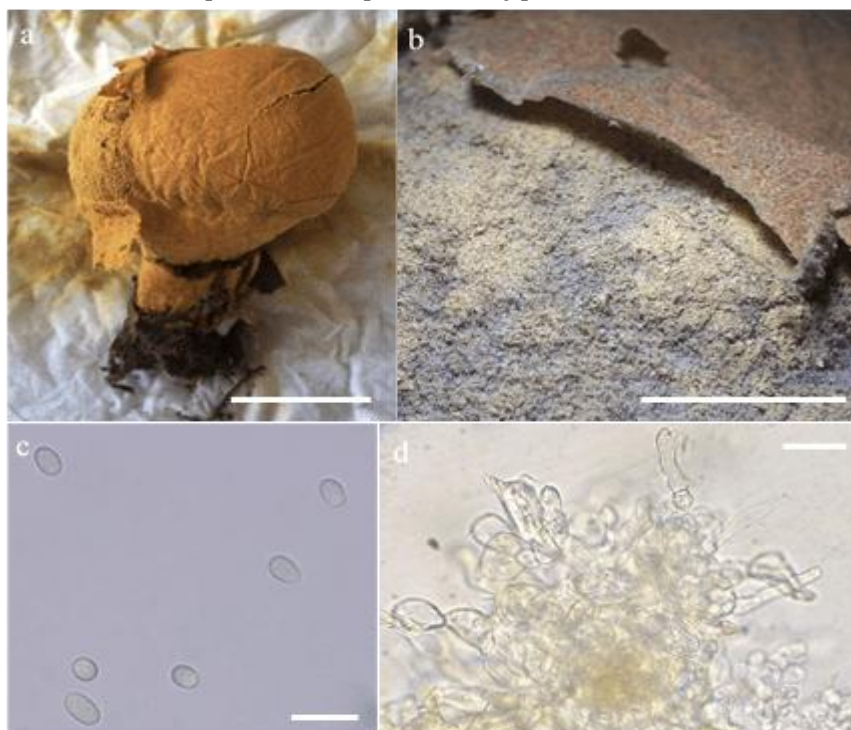


Fig. 1 *Calvatia pyriformis*. (a) mature fruiting body; (b) basidiospores masses; (c) basidiospores; (d) capillitium character. Scale bars: (a) 10 cm; (b) 1 cm; (c) 5  $\mu$ m; (d) 50  $\mu$ m.

#### D. CONCLUSION

*Calvatia pyriformis* was recorded in IPB University. It was saprobic mushroom grown on grass. This is first record for reporting *C. pyriformis* in Indonesia. It was described as pear-shaped or puffball-shaped, yellow to brownish outside and inside, the granular

outer surface, thin layer of exoperidium, and soft texture of fruiting body. Basidiospore is finely globose to ovoid and free of ornament. The capillitium was swollen and septate.

### Acknowledgment

The authors thanks to Mycology Division, Department of Biology, IPB University for the assistance.

### REFERENCES

- Baseia, I. G. (2003). Contribution to the study of the genus *Calvatia* (Lycoperdaceae) in Brazil. *Mycotaxon*, *88*, 107–112.
- Bates, S. T., Roberson, R. W., & Desjardin, D. E. (2009). Arizona gasteroid fungi I: Lycoperdaceae (Agaricales, Basidiomycota). *Fungal Diversity*, *37*, 153–207.
- Bisht, D., Sharma, J. R., Kreisel, H., & Das, K. (2006). A new species and a new record of Lycoperdaceae from India. *Mycotaxon*, *95*, 91–96.
- Brundrett, M. C., Bougher, N., Dell, B., Grove, T., & Malajczuk, N. (1996). *Working with mycorrhizas in forestry and agriculture*. ACIAR Monograph 32. <https://doi.org/10.13140/2.1.4880.5444>
- Cortez, V. G., & Alves, G. R. (2012). Type study of *Calvatia lachnoderma* from Brazil. *Mycosphere*, *3*(5), 849–898. <https://doi.org/10.5943/mycosphere/3/6/3>
- Gray, W. D. (1973). *The use of fungi as food and in food processing, part II*. CRC Press. Index Fungorum. (2018). *Calvatia*. <https://www.indexfungorum.org/names/namesrecord.asp?RecordID=155612>
- Ingold, C. T. (1965). Spore Liberation. In *Spore Liberation* (p. 210). Clarendon Press.
- Kasuya, T., & Retnowati, A. (2006). New or noteworthy species of the genus *Calvatia* Fr. (Basidiomycota) with probable medicinal value from Indonesia. *International Journal of Medicinal Mushrooms*, *8*, 283–288. <https://doi.org/10.1615/IntJMedMushr.v8.i3.100>
- Kirk, P. M., Cannon, P. F., Minter, D. W., & Stalpers, J. A. (2008). *Dictionary of the fungi* (10th ed.). CAB International.
- Kottapalli, S., Krishna, H., Venumadhav, K., Nanibabu, B., Jamir, K., Ratnamma, B. K., Jena, R., & Babarao, D. K. (2016). Preparation of herbarium specimen for plant identification and voucher number. *Roxburghia*, *6*, 111–119.
- Kuo, M. (2018). *Calvatia*. [www.mushroomexpert.com](http://www.mushroomexpert.com)
- Li, D.-W. (2011). Five trillion basidiospores in a fruiting body of *Calvatia gigantea*. *Mycosphere*, *2*(4), 457–462.
- Miller, O. K. (1973). *Mushrooms of North America*. Dutton Publisher.
- Moreno, G., Altes, A., & Kreisel, H. (1998). *Calvatia booniana* (Lycoperdaceae) new from Europe and Asia. *Feddes Reportorium*, *109*, 41–49. <https://doi.org/10.1002/fedr.19981090107>
- Mycobank. (2018). *Calvatia*. [https://www.mycobank.org/page/Name\\_details\\_page/name/Calvatia](https://www.mycobank.org/page/Name_details_page/name/Calvatia)
- Noverita, Sinaga, E., & Setia, T. M. (2016). Potential of macrofungi as a food and medicinal source from Lembah Anai and Batang Palupuh Natural reserve, West Sumatera. *Jurnal Mikologi Indonesia*, *1*(1), 15–27. <https://doi.org/10.46638/jmi.v1i1.10>
- Verma, R. K., Mishra, S. N., Pandro, V., & Thakur, A. K. (2018). Diversity and distribution of *Calvatia* species in India: a new record from Central India. *International Journal of Current Microbiology and Applied Sciences*, *7*(9), 2540–2551. <https://doi.org/10.20546/ijcmas.2018.709.316>