

Phallales of West Bengal, India. II. Phallaceae: *Phallus* and *Mutinus*Arun Kumar Dutta^{1,2}, Nilanjan Chakraborty¹, Prakash Pradhan^{1,2} and Krishnendu Acharya^{1*}

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Abstract: Four members of Phallaceae were collected from different corners of West Bengal and among them three are reported to be new to India and one from West Bengal. A detailed macro and microscopic features of those members were presented in this paper.

[Arun Kumar Dutta, Nilanjan Chakraborty, Prakash Pradhan and Krishnendu Acharya. **Phallales of West Bengal, India. II. Phallaceae: *Phallus* and *Mutinus*.** *Researcher* 2012;4(8):21-25]. (ISSN: 1553-9865). <http://www.sciencepub.net/researcher>. 5

Key words: Agaricomycetes, diversity, macrofungi, new record

1. Introduction

The diversity and galaxy of fungi and their natural beauty has prime place in the biological world. Studies on macrofungal diversity have been carried out by several countries, and new species for the world macrofungal flora have continuously been documented from all over the world. Macrofungi not only produce the well attracted variously colored fruiting bodies, but also play a significant role in day to day life of human beings by finding utilization in industry, agriculture, medicine (Chang and Miles 2004), food industry, bioremediation, natural cycling, in recycling nutrients and decomposing the dead organic matter in soil and litter, as biofertilizers and many other ways.

The state West Bengal treasures a milieu of ecological domains with variable combination of altitudinal, climatic and edaphic factors, which have allowed the biological diversity of the state to carve suitable niches for themselves and prosper accordingly. Literature review reveals that till date, only a fraction of total fungal wealth has been subjected to scientific scrutiny (Swapna *et al.* 2008), and for substantial exploration and analysis of macrofungal wealth of the country, regional inventorisation database needs to be built and they need to compiloede at the national scale. Our laboratory is in the process of surveying macrofungal diversity of the state and has so far succeeded in unveiling the existence of many species which were previously unknown in the region (Acharya and Bhutia 2003; 2004a, 2004b, 2005, 2010a, 2010b; Dutta *et al.* 2011a, 2011b; Pradhan *et al.* 2011). In this communication, we are reporting new record of *Phallus multicolor*, *Mutinus caninus* var. *caninus* and *Mutinus caninus* var. *albus* from India and *Phallus rubicundus* from West Bengal (Bilgrami *et al.* 1991).

2. Materials and methods

The study materials were collected during the field trips of various forested regions of West Bengal (2009–2011). The morphological and ecological features were noted and colour photographs were taken in the field. After the specimens were brought to the laboratory, microscopic features were determined by using Carl Zeiss AX10 Imager A1 phase contrast microscope. Specimens were identified according to Arora (1986), Zeller (1944), Smith (1904), Dring (1964), Berlese *et al.* (1888), Hemmes and Desjardin (2009). The voucher specimens have been deposited with the accession code AMFH in the Mycological Herbarium of University of Calcutta, Kolkata, West Bengal, India.

Observation

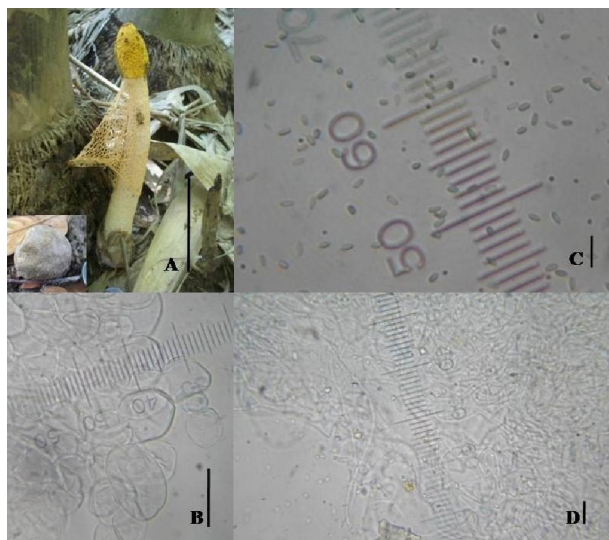
Phallus multicolor (Berk. & Broome) Cooke
Position in classification*: Fungi, Basidiomycota, Agaricomycotina, Agaricomycetes, Phallomycetidae, Phallales, Phallaceae, *Phallus*, *P. multicolor*

* <http://mycobank.org/MycoTaxo.aspx> accessed on 06.01.2012

Egg globose to subglobose, 35–41 mm × 35–40 mm, buff coloured, with a well develop, white coloured rhizomorph, consistency pliant due to the inner gelatinous layer, finally ruptured by an irregular slit and gives rise to a fleshy-gelatinous volva, an elongated stipe, a cap and an indusium. Mature fruit body 11.5–15.5 cm long, 2–3 cm broad, spike-like, with a pitted cap. *Cap* 2.5–3 cm long, 2 cm broad, consists of a thin membrane attached to apex of the stipe and pendant down the sides, covered with a slimy, olive-brown substance which eventually wears off, exposing a lemon-yellow surface, developing a perforation at the top, under surface smooth. *Indusium* attached under the

cap at apex of stipe, hanging 7.8 cm below lower margin of the pileus, netlike in pattern, the meshes about 1–2 mm broad, gradually smaller near margin, lemon-yellow to yellowish-orange in colour. Stipe 6–8.5 cm long, 2.5–3 cm broad at base, narrowed upward, with a perforated apex, yellowish-white, chambered. Volva 3–4 × 2–3.5 cm, sac-like, buff coloured.

Spores 3.94–4.33(–4.53) × 1.77–1.97 μm, [Q=2–2.5, Q_{av}=2.23, n=25 spores, s=2 specimens], long-elliptical to nearly cylindrical, hyaline. Outer layer of the stem composed of 28.37–31.52(–43.34) × 24.43–27.58(–35.07) μm, globose to subglobose, hyaline, smooth walled cells, wall 0.591 μm thick. Inner layer of the stem composed of 29.2–32.3(–59.9) × 27.6–42.6 μm, globose to subglobose, hyaline, smooth walled cells, wall 0.591 μm thick. Volva composed of 3.55–3.94 μm broad, hyaline, smooth walled, gelatinized hyphae.



Phallus multicolor A-Sporocarp bar=5 cm; B-Spores bar=10 μm; C-Sterile part under gleba bar=30 μm; D-Volva cells bar=20 μm.

Habitat: Terrestrial, scattered, in natural bamboo forest among fallen leaf litter mixed with humus.

Edibility: unknown.

Specimen examined: India, West Bengal: Howrah District, Amta, 22°58'47.66" N, 88°27'06.806" E and 19 ft. among fallen leaf litter mixed with humus, 31st July 2011, Nilanjan Chakraborty, AMFH 504.

Remarks: Till date five species of *Phallus* has been reported from India (Bilgrami *et al.* 1991), which includes *P. impudicus*, *P. nanus*, *P. ravenelii*, *P.*

rubicundus, and *P. rugulosus*. Our specimen differs from all those reported species in several aspects. *P. impudicus* has white coloured stipe, whitish to pinkish egg whereas *P. ravenelii* has whitish to pinkish or pinkish lilac coloured egg and much smaller spores than that of our specimen. Another reported species from Asia, *P. cinnabarinus* differs from our specimen in having a bit longer skirt, whitish coloured stem and cinnabar-red coloured cap.

Phallus rubicundus (Bosc) Fr.

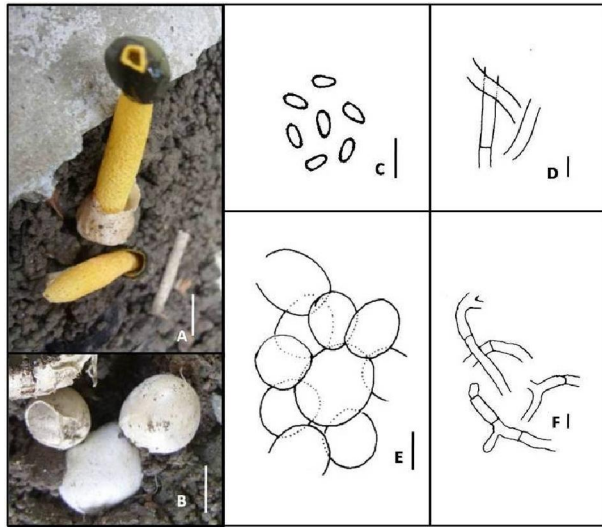
Common name: Devil's stinkhorn.

Position in classification*: Fungi, Basidiomycota, Agaricomycotina, Agaricomycetes, Phallomycetidae, Phallales, Phallaceae, *Phallus*, *P. rubicundus*

*<http://www.mycobank.org/Mycotaxo.aspx?Link=T&R ec=241457> accessed on 06.01.2012

Egg (unexpanded basidiocarp) ovate, smooth, 2–2.5 cm diam., with white rhizomorphs at base, mature basidiocarp 9 cm high. Receptacle cylindrical-fusoid, hollow; glebiferous part distinctly defined from the sterile portion (stipe), olivaceous, slightly thickened, conical, 1.6–1.8 × 1.5–1.6 cm, occupying only 1/4 to 1/6 of the whole length of the receptacle, delimited from the sterile portion, smell pungent and penetrating but not offensive. *Sterile portion* (stipe) orangish yellow, spongiose, tapered at apices, 0.8–1.1–0.9 cm wide at lower, middle and upper margin of stipe respectively. Flesh consists of two layers of chambers, opening outside, closed on the inner surface by a continuous thin layer. *Veil* absent. *Volva* saccate, 1.5–2 × 1.7–2 cm, white.

Basidiospores (2.8–)3.9–4.7(–5.9) × 2–4 [Q=1–1.5, Q_{av}=1.25, n=25 spores, s=2 specimens], Q_{av}=1.20, cylindrical, oblong to ellipsoid, hyaline, smooth. *Stipe* cells sub-globose to angular, hyaline, 15.76–35.46 × 13.79–19.7 μm, cell wall 1.18 μm broad. *Volva* composed of filamentous, septate cells, 16.15–23.64 × 4.33–7.88 μm, septa 0.78 μm wide, cells sometimes tapering towards the blunt to slightly bulbous apex, matrix granular with oil droplets. *Rhizomorph* whitish, 1.1 × 0.1 cm, solitary or doubly bounded cords, cortex cells subglobose to filamentous, septate, 8.27–9.85 × 7.88–8.67 μm. *Oliferous* cells present, sometimes septate, 2.36–39.4 × 4.02–5.91 μm. Peripheral cells filamentous, septate, 7.88–19.7 × 4.34–7.88 μm.



Phallus rubicundus A-Mature sporocarp bar=1 cm; B-Unexpanded basidiocarp (eggs) bar=1 cm; C-Basidiospores bar=10 μ m; D-Cells of rhizomorph cortex bar=10 μ m; E-Stipe cells bar=10 μ m; F-Volva cells bar=10 μ m.

Habitat: Gregarious, growing saprobically upon decaying plant litter, in shady and humid place.

Edibility: Unknown, but not recommended.

Specimen examined: India, West Bengal: Howrah district, Sankrail block, Podra, 22°56'69.863" N, 088°27'02.166" E and 16.4 ft. shady and humid place upon decaying plant litter, 29 August 2010, *Nilanjan Chakraborty*, AMFH 154.

Remarks: Review of literature reveals that *Phallus rubicundus* has been reported from West Africa (Dring, 1964), Brazil (Trierveiler-Pereira *et al.* 2009) and other parts of the world like Italy and Australia. This fungus can easily be confused with *Mutinus elegans* in structure but unlike *Phallus*, *Mutinus* bears slime directly on the upper part of the stalk and also lacks a well differentiated and detachable head which is a typical characteristic of *Phallus*. This fascinating stinkhorn is often identified as "*M. elegans*," but close inspection reveals that *P. rubicundus* has a clearly distinguished, separate head that holds the spore-saturated brown slime; species of *Mutinus* bear their slime on the upper part of a stem structure that lacks a clearly distinguished head.

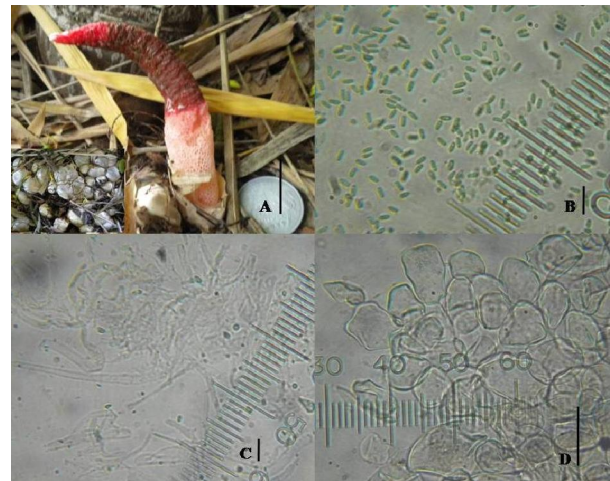
Mutinus caninus* var. *caninus (Huds.) Fr.

Position in classification*: Fungi, Basidiomycota, Agaricomycotina, Agaricomycetes, Phallomycetidae, Phallales, Phallaceae, *Mutinus*, *M. caninus*

*<http://indexfungorum.org/Names/NamesRecord.asp?RecordID=420515>

Egg white, 22 mm diam., 2.9 cm long, attached by a rhizomorph. **Fructification** a stalk 10.3 cm high when expanded, 2 cm broad at middle, narrowed towards apex, apex 5 mm broad, pinkish red, paler downward. Base sheathed by a volva, 2.6 cm long, 21 mm broad, creamish white in colour, attached by branched rhizomorph, more or less 27 mm long. **Gleba** olivaceous brown to dark pinkish red in colour, covering the upper 2/3 portion of the total height, odorous.

Spores 3.94–4.14(–4.33) \times 1.58–1.77(–1.97) μ m [Q= 2–2.75, Q_{av}= 2.23, n = 25 spores, s = 2 specimens], hyaline, smooth walled. The sterile part under the gleba composed of 30.73–31.91(–47.28) \times 24.03–27.19(–28.76) μ m, irregular shaped, hyaline cells, wall 1.182 μ m thick. Volva composed of (3.94)–4.33–5.91(–7.09) μ m broad, hyaline, smooth walled hyphae.



Mutinus caninus var. *caninus* A-Sporocarp bar=2 cm; B-Spores bar=10 μ m; C-Volva cells bar=10 μ m; D-Sterile part under gleba bar=30 μ m.

Habitat: Gregarious, on soil under *Bambusa bamboo* tree.

Edibility: Unknown.

Specimen examined: India, West Bengal: Midnapur district, Contai-II, 21°47'25.5" N, 087°46'12.6" E and 33 ft. under *Bambusa bamboo* tree garden on humus mixed with bamboo leaf litter, 25 July 2011, *Krishnendu Acharya* and *Arun Kumar Dutta* and *Prakash Pradhan*, AMFH 322; South 24 Parganas district, Kultali bazar, 22°15'64.8" N, 088°41'16.6" E and 15 ft. under *Bambusa bamboo* tree garden on humus mixed with bamboo leaf litter, 22 August 2011, *Arun Kumar Dutta* and *Prakash Pradhan*, AMFH 388.

Remarks: This specimen is very much close to

Mutinus elegans but differs from the shape of the stalk. In case of *M. caninus* var. *caninus* stalk equal to near apex and spore is slightly larger ($4-7 \times 2-2.5 \mu\text{m}$), where as in *M. elegans* stalk subfusiform or at least tapered from middle to apex and spore is slightly smaller ($4-4.3 \times 1.6-2 \mu\text{m}$).

***Mutinus caninus* var. *albus* Zeller**

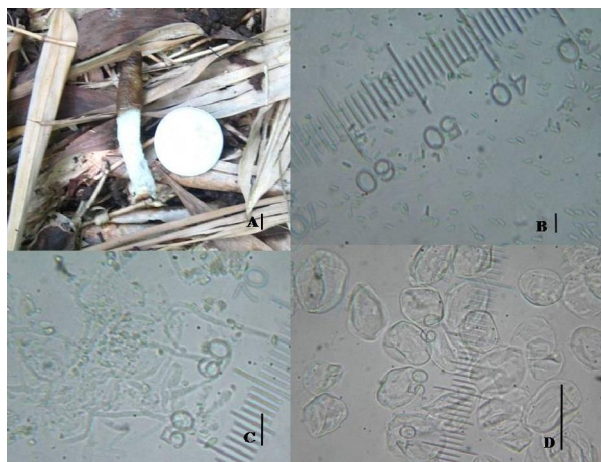
Common name: Dog stinkhorn

Position in classification*: Fungi, Basidiomycota, Agaricomycotina, Agaricomycetes, Phallomycetidae, Phallales, Phallaceae, *Mutinus*, *M. caninus*

*<http://mycobank.org/MycoTaxo.aspx?Link=T&Rec=351784>

Egg white, 17–18 mm diam., 2.2 cm long, ovoid, white, attached by a rhizomorph. *Receptaculum* 9 cm high when expanded, 10 mm broad, equal, white in colour, head 20 mm long, 9 mm thick, covered by silvery gray membrane which gradually exposed into olivaceous odorous gleba. Base sheathed by a persistent volva, 2.2–3 cm long, 18 mm broad, creamish white, attached by branched rhizomorph, more or less 35 mm long, branched.

Spores $3.94-4.14(-4.33) \times 1.58-1.77(-1.97) \mu\text{m}$ [$Q=2-2.75$, $Q_{av}=2.3$, $n=25$ spores, $s=2$ specimens], hyaline, smooth walled. The sterile part under the gleba composed of $35.46-47.28 \times 29.94-43.34 \mu\text{m}$, irregular shaped, hyaline cells, wall $1.58 \mu\text{m}$ thick. Volva composed of $3.94-4.33 \mu\text{m}$ broad, hyaline, smooth walled hyphae.



Mutinus caninus var. *albus* A-Sporocarp bar=1 cm; B-Spores bar=10 μm ; C-Volva cells bar=20 μm ; D-Sterile part under gleba bar=40 μm .

Habitat: Solitary to cluster among the Bamboo tree.

Edibility: unknown.

Specimen examined: India, West Bengal: Midnapur district, Kasaphaltala, $21^{\circ}43'322''$ N, $087^{\circ}31'050''$ E and 35 ft. under *Bambusa bamboo* tree garden on humus mixed with bamboo leaf litter, 24 July 2011, *Krishnendu Acharya, Arun Kumar Dutta and Prakash Pradhan, AMFH 323*.

Remarks: This is a variety of *Mutinus caninus*. The feature of pure white colour throughout except the gleba led to consider this specimen as *Mutinus caninus* var. *albus* (Zeller 1944). *M. caninus* var. *caninus* differs distinctly from *Mutinus caninus* var. *albus* by the presence of reddish to pinkish red or paler colour below the portion of gleba.

Key to the species:

Indusium present or rudimentary; distinguishable head that holds the spore-saturated slime.....***Phallus***

Indusium present, attached under the cap, net like in pattern, lemon yellow to yellowish orange colored.....***P. multicolor***

Indusium absent; glebiferous part distinctly defined from the stipe; stipe orangish yellow colored.....***P. rubicundus***

Indusium absent; stalk tapered to apex and consisting of gleba covering the upper part; slime on the upper part of the stalk lacks a clearly distinguished head.....***Mutinus***

Stalk pinkish to reddish colored, not subfusiform.....***M. caninus* var. *caninus***

Stalk white colored.....***M. caninus* var. *albus***

Acknowledgement:

The authors are thankful to the Department of Environment, Government of West Bengal for financial assistance.

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References

- [1] Acharya K, Bhutia TP. Two new contributions to the Thelephoraceae of Eastern Himalaya. *The Indian Forester*. 2003;129:1051-1052.
- [2] Acharya K, Pradhan P, Chakraborty N, Dutta AK, Saha S, Sarkar S, Giri S. Two species of *Lysurus* Fr.: Additions to the macrofungi of West Bengal. *Journal of Botanical Society of Bengal*. 2010a;64(2):175-178.
- [3] Acharya K, Pradhan R, Bhattacharya M, Choudhury J, Pradhan P, Rai M. On new records of three species of Macrofungi, *Helvella* from Darjeeling hills. *Journal of Environment and Sociobiology*. 2005;2(1&2):81-84.
- [4] Acharya K, Rai M, Pradhan P. Agaricales of Sikkim Himalayas: A Review. *Researcher*. 2010b;2(5):29-38.
http://www.sciencepub.net/researcher/research0205/05_2721_research0205_29_38.pdf
- [5] Acharya K, Rai M, Rai NP, Sen S. Three new species of *Russula*: Addition to the macrofungi of Sikkim. *The Indian Forester*. 2004a;130:953-955.
- [6] Acharya K, Rai M, Subba J, Gurung S. Two new species of *Lactarius* – new report from Darjeeling. *Indian Journal of Applied and Pure Biology*. 2004b;19:63-66.
- [7] Arora D. *Mushrooms Demystified* (2nd edition), 10 speed press. Crown Publishing Group, New York. 1986;p768
- [8] Berlese AN, De-Toni JB, Fischer E. 1888. *Sylloge Fungorum*. 1888;7(1):7
- [9] Bilgrami KS, Jamaluddin S, Rizwi M.A. *Fungi of India, Today and Tomorrow's Printers and Publishers, New Delhi*. 1991;p798
- [10] Chang S, Miles GP. *Mushrooms: Cultivation, nutritional value, medicinal effects and environmental impact*. CRC Press, USA, 2004;pp436
- [11] Dring DM. *Gasteromycetes of West Tropical Africa*. *Mycological Papers* 1964;98:1-60.
- [12] Dutta AK, Pradhan P, Roy A, Acharya K. A subtropical agaric new to India. *Kavaka*. 2011a;39:37-39.
- [13] Dutta AK, Pradhan P, Roy A, Acharya K. *Volvariella* of West Bengal, India I. *Researcher*. 2011b;3(5):13
http://www.sciencepub.net/researcher/research0306/03_5683research0306_13_17.pdf
- [14] Hemmes DE, Desjardin DE. Stinkhorns of the Hawaiian Islands. *Fungi* 2009;2(3):8-10.
- [15] Pradhan P, Dutta AK, Roy A, Acharya K. Boletales of West Bengal, India. I. Sclerodermataceae: *Pisolithus* and *Scleroderma*. *Researcher*. 2011;3(9):21-26.
- [16] Smith AH. *Puffballs and allies in Michigan*, University of Michigan press, USA. 1904;pp30-36
<http://name.umdl.umich.edu/AGK0823.0001.001>
- [17] Swapna S, Syed A, Krishnappa M. Diversity of macrofungi in semi-evergreen and moist deciduous forest of Shimoga district-Karnataka. *Indian Journal of Mycology and Plant Pathology* 2008;38(1):21-26.
- [18] Trierveiler-Pereira L, Loguercio-Leite C, Calonge FD, Baseia IG. An emendation of *Phallus glutinolens*. *Mycological Progress*. 2009;8:377-380.
- [19] Zeller SM. A white variety of *Mutinus caninus*. *Mycologia*. 1944;36(3):263-265.

16/8/2012