First report of the fleshy mushroom *Trichaleurina javanica* (Rehm) M. Carbone et al. (Ascomycota: Pezizales: Chorioactidaceae) from Southern India

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First report of the fleshy mushroom *Trichaleurina javanica* (Rehm) from southern India

Munuswamy Kumar 1, Sekar Nithya 2 & Antony Agnes Kayalvizhi 3

1, 2, 3 Department of Botany, Madras Christian College, Tambaram, Chennai, Tamil Nadu 600059, India.

1 kumarmccbotany@gmail.com (corresponding author), 2 nithyasekar19@gmail.com, 3 agnescruz4@gmail.com

**Abstract:** *Trichaleurina javanica* was collected from tropical dry evergreen forests, located in the southeastern coastal belt of India. This is the first report of the species from southern India. *Trichaleurina javanica* is a fleshy and rubbery cup-like mushroom, brownish-grey in colour with a brilliant yellowish-orange disc. The identification is supported using morphological and microscopical characters. It is one of the less known wild edible mushrooms belonging to Ascomycota.

**Keywords:** Ascomycetous mushroom, Ice Apple Mushroom, rubbery cup, tropical dry evergreen forests, wild edible mushroom.

*Trichaleurina javanica*, an ascomycetous mushroom, called Ice Apple Mushroom is a fleshy and rubbery cup like mushroom which is brownish-grey in colour with a brilliant yellowish-orange disc. *Trichaleurina* is a tropical and subtropical species which is complex and was not well resolved for its identity using well supported classical data until recently. It was separated recently from its allies *Galiella* and *Sarcosoma* and re-established as a separate genus recently (Carbone et al. 2013a, b) based on the phylogenetic evidence.

The most close allies *Galiella* with type *Galiella rufa* (Schwein.) Nannf. & Korf., is an American species (Carbone et al. 2015) which was later mentioned as *Trichaleurina javanica* by Patel et al. (2019).

Although, the name *Trichaleurina* was first used by Rehm et al. (1992), Malaysia (Chong et al. 2007; Abdullah & Rusea 2009) but poorly known from India (Pant & Prasad 2008). Sharma and Rawla (1982) reported *G. rufa* from India but due to unavailability of the specimens, identity remained doubtful and it is later mentioned as not recorded in India (Pant & Prasad 2008). Whereas, other species of *Galiella* namely *G. celebica* is reported from India (Pant & Prasad 2008) and was later mentioned as *Trichaleurina javanica* by Patel et al. (2019).

The genera *Galiella* is considered a synonym of *Sarcosoma* Casp. by Le Gal (1958, 1960) and Boedijn (1959) while many other mycologists from Korf (1957) to Pant & Prasad (2008) considered it as a separate genus. Recently, Carbone et al. (2013a, b, 2015) proved *Galiella* is an independent genus in the family Sarcosomataceae Kobayasi with at least two species *G. javanica* and *G. celebica* which were formerly included in the same genus.

Later, the phylogenetic studies on Sarcosomataceae revealed that *G. javanica* and *G. celebica* cannot be grouped under the genera and were therefore shifted to the genera *Trichaleurina* (Carbone et al. 2013a).

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(1903) as an infrageneric rank within *Aleurina* Massee., it was later raised to the genus level (Rehm 1914) by validating it with the new (and only) species *Trichaleurina polytricha* collected from the Philippines. But much later (Carbone et al. 2013b), the genus *Trichaleurina* was established with well supported morphological and molecular evidence with at least two clearly defined species—*T. javanica* and *T. tenuispora*. Moreover, Carbone et al. (2015) also clearly distinguished *G. rufa* by giving a detailed description of the micro-morphological characters for clear identification in future.

This *Galiella* complex (until recently) mushroom which is mustard yellow to light tan in colour is known as ‘Mata Rusa’ (deer eyes) in Sabah, by Dusuns and ‘Mata Kerbau’ (buffalo eyes) in Sarawak, Malaysia (Abdullah & Rusea 2009) was consumed and prized in the market. In India, we found the same mushroom is consumed raw by the Oorali tribe of Sathyamangalam forest (not reported earlier). This is not reported as an edible fungi from any other part of India.

Mushroom diversity of tropical dry evergreen forests (TDEF) vegetation is poorly reported (Kumar 2020). The actual diversity of these regions is much more than what is known, because TDEFs are among the highly neglected region for mushroom biodiversity studies. The species reported in this study was collected during mushroom biodiversity studies in the TDEF region of southern India being done for the past seven years (2012–2019).

**Materials & Methods**

The specimens were found on dead and decaying wood (*Delonix*) and collected from Madras Christian College campus, Chennai, India. The campus is a green, extended over 365 acres with TDEF vegetation. The specimens were cut from the stump in all stages starting from initial fruiting to mature stage. Specimens from the field were wrapped in paper covers. They were dried at 70°C for 24 hours and sealed in polythene covers along with their label and naphthalene balls for further examination (Kaviyarasan et al. 2009). The microscopic structures were examined in the dried specimens which were as revived in 5% KOH. Stains such as phloxine and Melzer’s reagent were used to study other details (Largent 1986). The specimens were deposited in the Madras Christian College Herbarium (MCCH) with accession MCCHF1601, MCCHF1920 for future reference. They were identified with proper keys and manuals (Cao et al. 1992; Pant & Prasad 2008; Carbone et al. 2013a,b, 2015; Patel et al. 2019).

**Results & Discussion**

In the present study the fruit bodies of *Trichaleurina javanica* were collected throughout the Madras Christian College Campus. They were always collected on dead and decaying wood.

*Trichaleurina javanica* (Rehm)

M. Carbone, Agnello & P. Alvarado (2013) (Image 1; Figure 1)

≡ *Sarcosoma javanicum* Rehm, Hedwigia 32: 226 (1893)
≡ *Galiella javanica* (Rehm) Nannf. & Korf, Mycologia 49 (1): 108 (1957)
≡ *Urwnula philippinarum* Rehm, Leaflets of Philippine Botany 6: 2281 (1914)
≡ *Trichaleurina polytricha* Rehm, Leaflets of Philippine Botany 6: 2234 (1914)
≡ *Sarcosoma novoguineense* Ramsb.: 186 (1917), fide Boedijn (1932) and Le Gal (1959)
≡ *Sarcosoma decairy* Pat., Mémoirs de l’Académie Malgache 6: 37 (1928), fide Le Gal (1953)

**Macroscopic features**

Sporocarps occur in troops, clusters, or singly. Fruiting body cup-shaped, cup curved inwards during initial stage, leathery. Inner tissue gelatinous, jelly like, translucent and rubbery, smooth, outer surface blackish-brown to grey brown in colour, rough, velvety, smooth or wrinkled, 5.2–7.8 cm wide and 5.5–6.5 cm high, cylindric or tapering downwards, hairs sparse throughout the surface, more hirsute hairs along the rim of the cup, at maturity the hairs not significant, hymenial portion reddish-orange to yellowish-orange, concave when young, at maturity the hymenial region prominent, plane, convex and slightly decurving . Margin entire, at maturity sparsely folded. Inside the cup below the hymenial region cavity present, cavity may be partitioned with two locule, gelatinous tissue getting reduced towards the base. Cavity filled with mild gelatinous fluid, fluid colourless and odourless. As much as 20ml of fluid accumulate in the cavity. At initial stage and also at maturity the fluid may not be present.

**Microscopic features**

Hymenium thick, ascospores large, thin walled, with prominent oil guttules, spores hyaline, inamyloid, elliptical, 30.9–35.8, 12.7–15.2 mm, tilted towards right with two to three large prominent oil guttules and few smaller guttules, ascospores at the tip are smaller than those at the bottom. Asci narrow, long, cylindrical, operculate, unitunicate, wall thick up to
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Image 1. *Trichaleurina javanica*: a—habit – young | b—habit – mature | c—v.s. of apothecium showing the hymenium | d—ascus with ascospore and showing operculum | e—paraphyses showing uneven wall layer | f—paraphyses showing septum | g—gelatinized hyphae of hypothecium | h—excipulum region of ascocarp | i—septate hyphae of the excipulum. © M. Kumar.
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1.5mm, spores vertically arranged to the length of the asci, 374–388 × 8.1–8.3 mm, callose depositions found on the wall. Paraphyses filiform, extending beyond asci, 4–8 mm diameter, gradually tapering downwards, septate, septum not prominent, septal wall thin, depositions present on the tip portion, wall not smooth, uneven. Subhymenium, pale or creamy, appears pseudoparanchymatous and partially with gelatinized hyphae.

Hypothecium with gelatinized hyphae with watery cavity, all hyphae septate with visibly dark septum, thin, 3–6 mm diameter, sparsely branched, wall layer are hyaline and has some warty ornamentation. Hypothecium and excipulum separated with cavity. Excipulum rubbery with gelatinized hyphae and towards outer dark brown hyphal aggregation present, some dark deposition on the walls, wall layer dark, hyphae erect and septate with prominent dark septum, tip blunt.

**Specimen examined:** MCCHF1601, MCCHF1920, 19.viii.2016 and 29.x.2019, India, Tamil Nadu, Chennai, Madras Christian College Campus, in troops (15–20 sporocarps), around MacPhail art center (12°55'10.96"N 80°7'18.91"E), coll. M. Kumar.

The specimen examined shows similarity with the previously reported species mentioned from China, Taiwan, Thailand, and Seychelles (Cao et al. 1992; Carbone et al. 2013b) with slight variation in the morphological and microscopical dimensions. It was unable to compare with the Indian species (Patel et al. 2019) because the report from Gujarat was not described using micromorphological characters rather identified only by molecular analysis.

The morpho-microscopic examination in the present study includes the notable characters such as gelatinous liquid: its presence and absence, quantity and taste, presence of two locules in the fluid cavity, septate hyphae of gelatinous excipulum, which were not recorded in the previous reports (Cao et al. 1992; Pant & Prasad 2008; Carbone et al. 2013a,b, 2015).

*Trichaleurina javanica* contains a mild salty sweet liquid which is similar to that of the liquid found in palmyra palm fruit. During our collection it was also observed that the sporocarp is vigorously fed by few larvae and common snail of this region.

Since the species was already reported by Pant & Prasad (2008) from the Kumoun hills, Uttarakhand as *Galiella celebica* and by Patel et al. (2019) from Gujarat as *Trichaleurina javanica*, this will be the first report for southern India.

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