

NOTE

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First record of *Tricholoma fulvocastaneum* from Thailand

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Abstract *Tricholoma fulvocastaneum* is recorded from Thailand for the first time. This edible ectomycorrhizal fungus is associated with *Castanopsis tribuloides* (Fagaceae) in mixed evergreen forest in northern Thailand. Conventional and molecular methods were carried out to confirm its identity.

Key words Ectomycorrhiza · Edible mushroom · Tricholomataceae

In northern Thailand, many species of wild edible mushrooms are collected by local people during the rainy season (June–September). Most are ectomycorrhizal fungi and include *Amanita* spp., *Russula* spp., *Lactarius* spp., *Cantharellus* spp., *Craterellus odoratus*, *Phaeogyroporus portentosus* (Berk. & Broome) McNabb, *Heimiella subretispora* Corner, and *Astraeus hygrometricus* (Pers.) Morgan (Sanmee et al. 2003). The forests of northern Thailand are diverse and contain many families of ectomycorrhizal trees such as the Pinaceae, Fagaceae, Betulaceae, and Dipterocarpaceae. Depending on altitude and host trees, the associated ectomycorrhizal fungi have affinity with both temperate and tropical fungal floras. However, the mountains are not high enough to support the vegetation characteristic of Matsutake (= Songrong) [*Tricholoma matsutake* (S. Ito et Imai)

Sing. or Jia Songrong (*T. bakamatsutake* Hongo)] of western Yunnan.

The present article is the first report of *T. fulvocastaneum* Hongo, a fungus with a very distinctive appearance, that was found fruiting abundantly in upland forests during surveys of ectomycorrhizal fungi in northern Thailand. The fungus was found in mixed evergreen forest under *Castanopsis tribuloides* A. DC., which normally supports a wide range of ectomycorrhizal fungi.

Basidiomata were collected in June 2002 from Khun Chang Kian, Doi Suthep-Pui National Park, Chiang Mai Province, Thailand, at about 1200–1300m above sea level. It is a primary evergreen forest consisting of *Castanopsis acuminatissima* Rehder, *C. echinocarpa* A. DC., *C. tribuloides*, *Cleidion spiciflorum* Merr., *Ficus* sp., *Schima wallichii* Choisy, *Styrax benzoides* Craib, and *Syzygium cumini* (L.) Skeels. The soil is loamy with high organic matter content. Whole sporocarps, including the base of the stipe, were collected with a sharp implement. Soil was removed gently with a brush, and the sporocarps were placed in brown paper bags in a basket for transport to the laboratory.

Macroscopic morphological details of fresh specimens, such as size, shape, color, and texture, were recorded. Microscopic features were determined from rehydrated sections of basidioma mounted in 5% (w/v) KOH and stained with 1% (w/v) Congo Red.

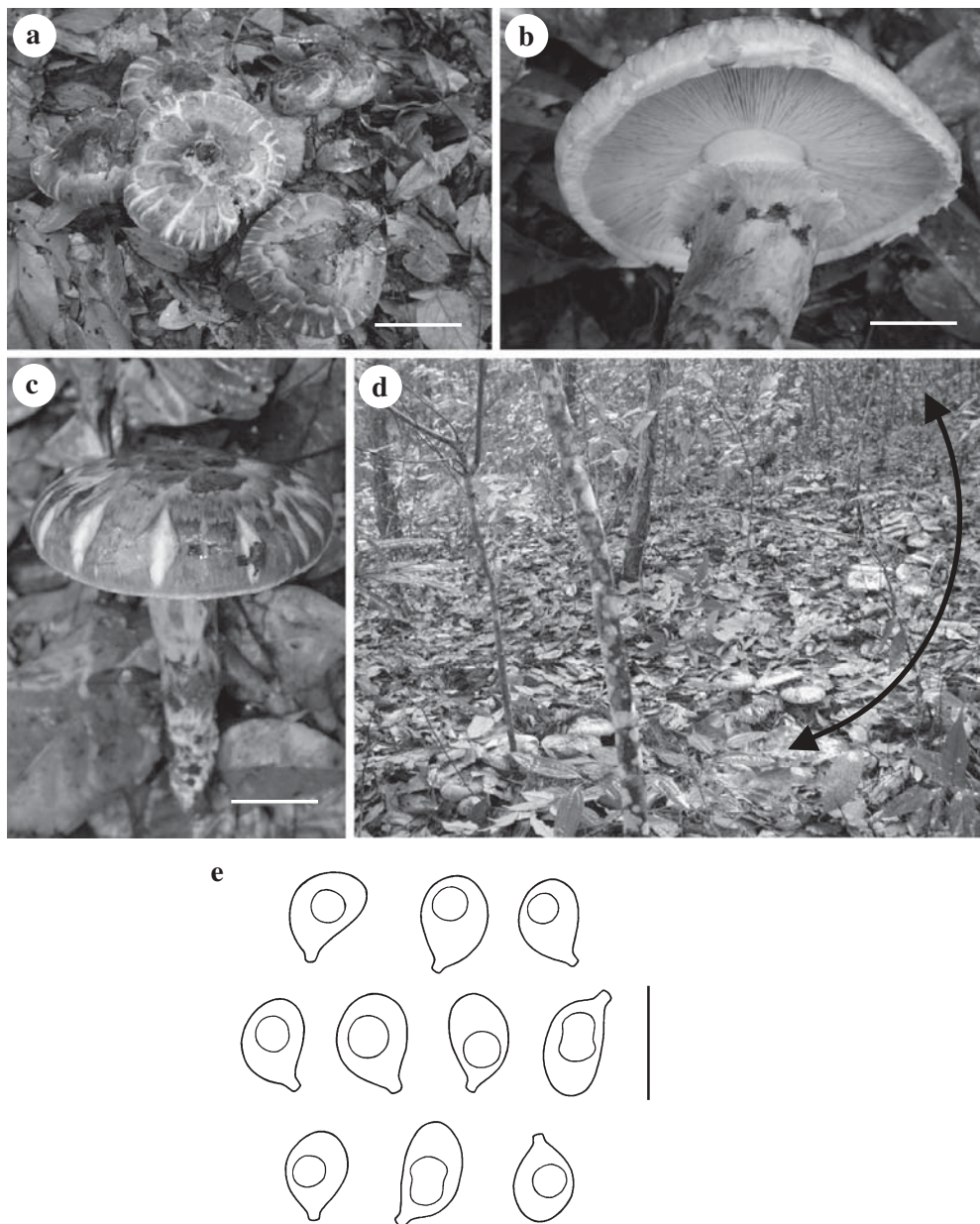
A small piece of fresh gill was frozen in liquid nitrogen and ground in the extraction buffer of Raeder and Broda (1985) in a 1.5-ml Eppendorf tube with a glass rod. DNA was extracted, and the internal transcribed spacer (ITS) region was amplified by polymerase chain reaction (PCR) methods using ITS1 and ITS4 primers as described by Taylor et al. (2005). PCR products were purified using Ultrabind DNA purification kit (MO BIO Laboratories, California, USA). Sequence reactions were carried out with the BigDye terminator cycle sequencing kit (PE Applied Biosystems, Foster City, CA, USA) using the primers ITS1 or ITS4. Sequence was performed on an ABI Prism 377 DNA sequencer (PE Applied Biosystems, Foster City, CA, USA) according to the manufacturer's protocols.

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Fig. 1. *Tricholoma fulvocastaneum* (CMU 25007). **a** Basidiomata at different stages of development. **b** Gills and annulus. **c** Basidioma showing dense scales of appressed fibrillose tissue and rather steeply tapered stipe base. **d** Fairy ring (arrow) around *Castanopsis tribuloides*. **e** Basidiospores. Bars **a** 6 cm; **b** 3 cm; **c** 4 cm; **e** 10 μ m



Tricholoma fulvocastaneum Hongo in J. Jpn. Bot. **35**: 86, figs. 2/IV–V (1960) Figs. 1a–e

Basidiomata medium to large, thickset. Pileus 10–15 cm in diameter, at first hemispherical then convex to broadly convex, becoming plane with broad umbo at disk, chestnut brown, darker at disk, paler toward margin; appressed fibrillose, with dense scales especially near the center, scales often cracked and divided into peeling layers; margin incurved and with cinnamon-buff woolly veil remnants when young. Lamellae sinuate or adnexed, white to cream, crowded. Stipe 12–15 \times 2–3 cm, rather abruptly attenuated at the base, white and smooth above the annulus, covered with concolorous appressed fibrous scales below the annulus. Annulus submembranous, rarely cortinate, superior, subpersistent, whitish inside, subconcolorous outside. Trama white, thick, solid.

Lamella trama subparallel. Basidia 28–43 \times 7–9 μ m, clavate, 4-spored; sterigmata 4.5–6.0 μ m long. Basidiospores [30/1/1] (6.0–) 6.5–8.0 (–8.5) \times 5.0–5.5 μ m [Q = (1.15–) 1.33–1.42 (–1.54), Q = 1.35 \pm 0.11], ellipsoid, sometimes broadly ellipsoid, colorless, inamyloid, guttulate, hyaline, thin-walled, smooth. Clamps absent.

Local name: hed ngu leaumm.

Specimens examined: Thailand. Chiang Mai Province, Doi Suthep-Pui National Park, Khun Chang-Kian, June 14, 2002, R. Sanmee (CMU 25007).

Habitat and distribution: Gregarious in circular (fairy ring) pattern on the ground under *Castanopsis tribuloides*.

Notes: This species is very similar to *Tricholoma matsutake*, but differs distinctly in the fulvous-castaneous color, in the tapered base of the stem, and in lacking the strong particular smell (Hongo 1960). Masai (<http://www.5b>).

biglobe.ne.jp/~tmasai/nisema.html, as of Feb. 20, 2004) states that “This species resembles *T. matsutake* but grows with broad leaf trees such as *Quercus serrata* Roxb.”

ITS sequences of basidiome (GenBank accession no. DQ067895, 830 bp) collected in Thailand share 99% homology with those of *T. fulvocastaneum* available on GenBank; AB036901 (direct submission by H. Murata) and AF204808 (Kikuchi et al. 2000), and it is distant from other Asian *Tricholoma* spp., including *T. matsutake* and *T. bakamatsutake*, as shown by Matsushita et al. (2005).

Tricholoma fulvocastaneum, or “hed ngu leaumm,” is a new record for Thailand. The description of the Chiang Mai collection closely matches the original description (Hongo 1960) of *T. fulvocastaneum* and is distinct from *T. matsutake* (true matsutake), *T. bakamatsutake* (false matsutake), and *T. zangii* Cao, Yao et Pegler, which occur in Yunnan (Cao et al. 2003; Matsushita et al. 2005). Although edible, *T. fulvocastaneum* is not popular in the Matsutake market in Japan. According to Yun et al. (1997), the most important edible species for the Matsutake market are *T. matsutake* from Japan, China, and Korea, *T. magnivelare* (Peck) Redhead (white matsutake) found in Canada and the United States, and *T. caligatum* (Viv.) Ricken, which occurs mainly in Europe, North Africa, and the United States. In contrast to these species, the basidiomata of “hed ngu leaumm” lack strong aroma and taste. “Hed ngu leaumm” is not yet popular in Thailand because few people know this mushroom. The main groups who know this mushroom are the local people who live on or near the mountains in northern Thailand, although inquiries suggest that some local people have never tried this species. One reason given was that the fairy ring of this mushroom in the forest looks like

a giant snake crawling around the trees. However, it could be one of the interesting edible mushrooms in the future for Thailand.

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