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Some species of wild Boletes in Thailand

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Wild boletes were studied in the South, North and Northeast of Thailand. There were identified, into 9 species as follows: *Boletellus ananas* (M.A.Curtis) Murrill, *Boletellus emodensis* (Berk.) Singer, *Boletus griseipurpureus* Corner, *Boletus nanus* (Massee.) Singer, *Heimiella retispora* (Pat. & C.F. Baker) Boedijn, *Phlebopus colossus* (R.Heim) Singer, *Pulveroboletus ravenelii* (Berk. & M.A.Curtis) Murrill, *Strobilomyces confusus* Singer and *Strobilomyces floccopus* (Vahl) P. Karst., Among them, *P. colossus* is the most common found in the North and Northeast while *B. griseipurpureus* is commonly found in the South of Thailand.

Key words: Boletes, Mushroom

Introduction

Boletes are freshy pored mushroom which belong to Boletales. This order includes some gilled mushrooms in the families Gomphidiaceae and Paxillaceae, which have the same flesh texture and similar micromorphological and molecular phylogenetic characteristic (Hawksworth *et al*.,1995). The most widely accepted classification is Singer (1975) who classified boletes into four families as follows: Boletaceae, Gomphidiaceae, Paxillaceae and Strobilomycetaceae while Hawksworth *et al.* (1995) classified boletes into 11 families. The species diversity have been studied in several countries such as Malaysia (Corner, 1972), North America (Snell and Dick, 1970; Both, 1993), Germany (Moser, 1994), Japan (Imazeki *et al*., 1990) and Switzerland (Breitenbach and Kranzlin, 1991). At the present, about 727 species belonging to 70 genera of boletes have been described (Hawksworth *et al.*,1995) but few species have been reported in Thailand (Chansrikul, 1977; Choieklin and Dhitaphichit, 1999; Klingesorn *et al*., 1998a ; Klingesorn *et al*., 1998b. Jones *et*

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al., 1994; Petcharat *et al*., 1999; Phongpaichit *et al.*, 1999; Ruksawong and Flegal, 2001; Seehanan, 2007; Seehanan *et al.*, 2007 and Soytong, 1994).
The objective of this study was to collect and identify the wild edible boletes in the North, Northeast and South of Thailand.

Materials and methods

Surveys and collections of boletes were mostly taken in the South and occasionally in the North and Northeast of Thailand, during 2000 – 2005. The specimens were carried out as described by Arora (1985). The following characteristics of each species were recorded such as size, color, spore print and morphology of pileus and stripe etc. The microscopic characteristics was followed the method as described by Largent *et al.* (1977). The identification was attempted using the available lilerature listed in the reference section. All specimens were submerged in 70% ethyl alcohol and deposited at Mycological Herbarium of the Department of Pest Management, Faculty of Natural Resources, Prince of Songkla University, Hat Yai, Songkhla, Thailand.

Results

Nine species of boletes were identified and described as follows:
***Boletellus ananas* (M.A Curtis) Murrill** (= *Boletus ananas* M.A Curtis)
Local name: Hed Phung Chat

Macroscopic features: Pileus 7.0 – 9.0 cm. across, spherical to convex, dry, tomentose, cracking into coarse squamules, pale fuscous tan; margin irregularly appendiculate with the woolly remains of the veil, white when young, then brown red. Fresh thick, whitish, unchanging when injured.Tube large, yellow, then brown red to brown at maturity. Stipe 6.0 – 7.0 cm long, 2.0 – 2.5 cm across, slightly tapering downward, coarse with longitudinally fibrillose, ground color white to cream, dotted with red to orange red striate, apex reddish, white mycelium at base.

Microscopic features: Basidia 30.0 – 42.5 x 15.0 – 17.5 micron, clavate. Basidiospores 16.0 – 23.0 x 7.5 – 9.5 micron, elliptic to fusiform, coarsely striate with ridges, brown. (Fig. 1).

Reference: Corner (1972), Kuo (2005) and Weber and Smith (1985).
***Boletellus emodensis* (Berk.) Singer** (= *Boletus emodensis* Berk.)
Local name: Hed Phung Chat

Macroscopic features: Pileus 4.5 – 10.0 cm across, hemispherical to convex, dry, purple, dull crimson to rose red, finely tomentose, then cracking into large and small scales, sometimes recurved, or subpyramidal warts, margin

at first far exceeding the pores and covering them with a false veil, then splitting radially and stellately. Fresh yellow, blue when bruised. Tube subangular, thick and firm, yellow when young, then brown. Stipe 5.0 – 11.0 cm long, 1.0 – 2.0 cm across, cylindric or slightly tapering downward, brown, yellow at apex, base with white mycelium.

Microscopic features: Basidia 13.7- 15.0 x 25.5 – 27.5 micron, clavate. Basidiospores 15.0 – 17.5 x 7.5 – 10.0 micron, elliptic to fusiform, coarsely striate with ridges, brown (Fig. 2).

Reference: Corner (1972).

Boletus griseipurpureus **Corner**

Local name: Hed Sa med

Macroscopic features: Pileus 3.0 – 6.0 cm across, convex to plane, grey to purple or light purple, surface covered with gray black short soft hairs when young. Fresh white and firm when young, later solfter, unchanging when injured.Tube small and firm, pallid white when young, later pinkish to pale brown. Stipe 3.0 – 6.0 cm long, 1.5 – 3.0 cm across, purple, cylindric to clavate, increasing in thickness to clavate toward the base, sometime with pale brown net at the apex.

Microscopic features: Basidia 24.0 – 40.0 x 8.0 – 10.5 micron, clavate. Basidiospores 3.1 – 4.9 x 7.8 – 10.7 micron, cylindric, pinkish pale brown, smooth (Fig. 3).

Reference: Corner (1972).

Boletus nanus **(Massee.)** Singer

Macroscopic features: Pileus 1.0 – 2.5 cm across, convex, dry, subtomentose, becoming cracked and squamulose towards the margin, at first wholly dark olivaceous umber, paler on expansion and yellowish olivaceous to yellowish fawn, more or less fuscous in the center, margin slightly appendiculate at first and closely pressed to the stem. Fresh thinner, bright yellow, unchanging when bruise or cut. Tube subangular, pallid white then pinkish or purple. Stipe 1.5 – 2.0 cm long, 4.0 – 5.0 mm wide, cylindric or attenuate at the base, solid, scurfy squamulose or subtomentose, apex smooth, golden yellow to golden ochre; base attached by the pale yellow ochre mycelium in soil.

Microscopic features: Basidia 20.0 – 28.0 x 9.0 – 13.0 micron, clavate. Basidiospores 10.0 – 11.0 x 4.0 – 4.5 micron, boletiod shape, dirty pink or pale pink, smooth (Fig. 4).

Reference: Corner (1972).

Heimiella retispora **(Pat. & C.F Baker**) Boedijn (= *Boletus retisporus* Pat. &C.F. Baker).

Local name: Hed Phung Kha Dang, Hed Phung Nok Yoong

Macroscopic features : Pileus 3.0 – 10.0 cm across, convex to plane at maturity, dull red when young, then pink, surface dry, coarsely. Fresh thick, yellow, unchanging when wounded or bruised.Tube small and firm when young, then spongy, yellow green. Stipe 5.0 – 15.0 cm. long, 1.5 - 2.0 cm across, dull red, yellow at the apex, cylindric to ventricose, tapered and fusiform toward the base, surface with red longitudinal fibrils on cream colored background, firm fleshed.

Microscopic feature: Basidia 33.0 – 40.0 x 12.0 – 15.0 micron, subclavate. Basidiospores 10.5 – 13.5 x 8.0 – 10.0 micron, ellipsiod, verrucose with only a fragmentary network at best, thick walled, yellow brown (Fig. 5).

Reference : Corner (1972).

***Phlebopus colossus* (R. Heim) Singer** (= *Boletus colossus* R. Heim)

Local name: Hed Tab Tao Dam, Hed Nam Phung, Hed Har

Macroscopic features: Pileus 8.0 -20.0 cm. across, convex, thick and firm, black, smooth, surface lubricous viscous when moist. Fresh yellow, unchanging when bruised or cut. Tube pore small and firm, mounths yellow to greenish at maturity. Stipe 4.0 -6.0 cm long, 3.0 – 4.0 cm across, thick, stipe attachment at central, cylindric to slightly clavate, with a black on a cream background.

Microscopic features: Basidia 10.0 – 12.5 x 6.2 – 7.5 micron, clavate. Basidiospores 6.2 – 7.5 x 5.0 – 7.5 micron, subglobose, smooth, thin walled, light brown (Fig. 6).

Reference: Corner (1972).

***Pulveroboletus ravenelii* (Berk. & M.A. Curtis) Murrill**

Local name: Hed Phung Pha Aom

Macroscopic features: Pileus 2.0 - 3.5 cm across, convex then plane, dry, brilliant opaque sulphur yellow to chrome, often purplish, brownish scurfy over the center and cracking, cottony fibrillose over the limb, weathering fuscous or fawn and, sometimes, appressedly squamulose; margin appendiculate with fragments of the yellow and friable veil. Fresh soft, whitish to yellow changing to greenish blue when bruised, sometime brown or yellow. Tube quite small, subangular or slightly sinuate, green to yellow when young, changing to greenishblue when bruise, pale brown to blackening. Stipe 4.0 – 10.0 cm long, 1.0 cm across, equal or tapering downward or ventricose, pulverulent when young, later fibrilose, bright yellow, base whitish to yellow, with a slight superior annulus or occasionally with annular rings; whithin yellow, sometime base attached by the light yellow mycelium in soil.

Microscopic features: Basidia 24.0 - 35.0 x 10.0 -14.0 micron, clavate, hyaline. Basidiospores 8.0 - 11.2 x 4.0 - 6.4 micron, olive green, ellipsoid to oblong ellipsoid (Fig. 7).

Reference: Corner (1972), Phillips (1991), Thiers (1975), Weber and Smith (1985).

***Strobilomyces confusus* Singer**

Local name: Hed Ta Thao

Macroscopic features: Pileus 3.0 – 10.0 cm across, hemispherical when young, later plane, surface less inclined to be cottony or woolly and with white showing, and the scales, spines or warts mostly smaller, acute, rather hard and firm but often cottony and not rigid, gray black. Fresh whitish, greenish to reddish when wounded or bruised, later turning blackish.Tube pore large and subangular, black, spongy, sometime have scales. Stipe 8.0 -12.0 cm long, 1.0 – 2.0 cm across, gray black, smooth, cylindric, somewhat equal or slightly tapering downward.

Microscopic features: Basidia 15.0 - 20.0 x 8.7 – 10.0 micron, clavate Basidiospores 7.5 – 12.5 x 7.5 micron, subglobose to slightly ellipsoid, verrucose, with only a fragmentary network at best, blackish brown (Fig. 8).

Reference: Phillips (1991), Snell and dick (1970), Weber and Smith (1985).

***Strobilomyces Floccopus* (Vahl.) P. Karst** (= *Strobilomyces strobilaceus* (Scop Fr) Berk.)

Local name: Hed Ta Thao

Macroscopic features: Pileus 4.0 – 12.0 cm across, hemispherical when young, later plane, surface coarsely areolate squamose, scale pyramidal and erect, brown black and then black. Fresh spongy, whitish, graynish reddish when cut or bruised, later turning blackish. Tube angular, elongated toward the stipe, whitish when young, later gray brownish. Stipe 4.0 – 10.0 cm long, 1.0 – 1.5 cm across, thick, equal or slightly tapering downward, somewhat widned at the apex, gray black, surface coarsely floccose fibrillose, apex when young with well - defined, woolly fibrillose, whitish veil, solid, corticated.

Microscopic features: Basidia 15.0 – 20.0 x 10.0 micron, clavate. Basidiospores 7.5 – 12.5 x 7.5 – 10.0 micron, subglobose to slightly ellipsoid, reticulate, blackish brown (Fig. 9).

Reference: Kuo (2005), Phillips (1991), Snell and Dick (1970)

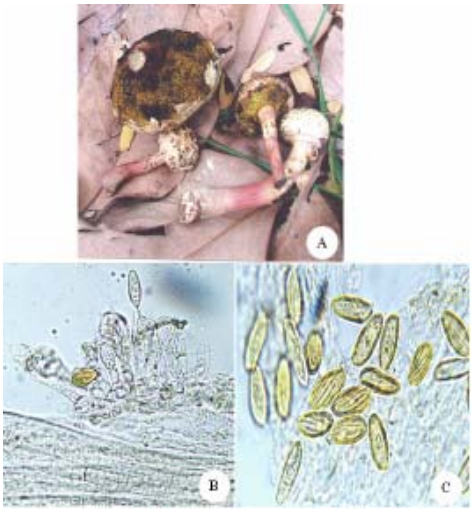

Fig. 1. *Boletellus ananas* (M.A. Curtis) Singer **A=** basidiocarps, B= basidia and basidiospores and C=basidiospores.

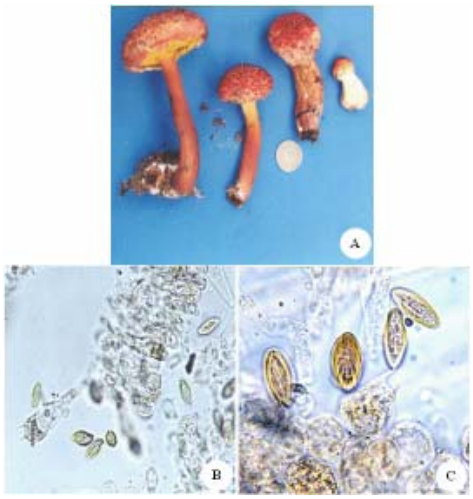

Fig. 2. *Boletellus emodensis* (Berk**)** Murrill A= basidiocarps, B= basidia and basidiospores and C= basidiospores and basidium.

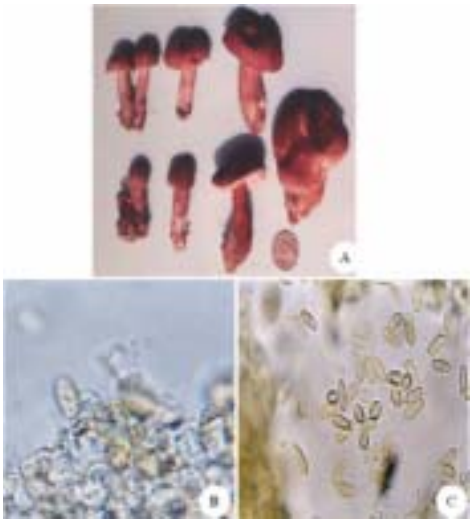

Fig. **3.** *Boletus griseipurpureus* Corner A= basidiocarps, B. basidia and basidiospores and C= basidiospores**.**

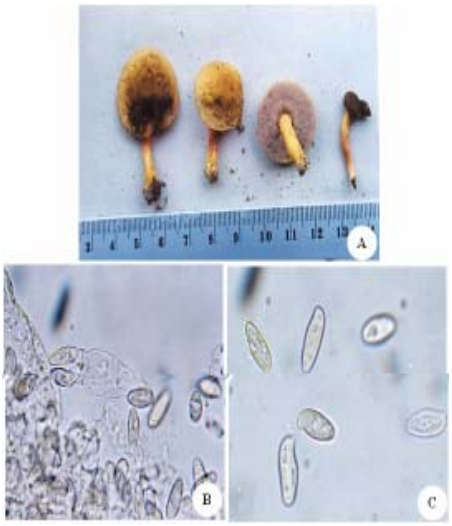

Fig. 4. *Boletus nanus*(Massee.) Singer A=basidiocarps, B= basidia and basidiospores and C= basidiospores**.**

Fig. 5. *Heimiella retispora* (Pat. &.F.Baker) Boedijn. A= basidiocarps B= basidia and basidiospores and C= basidiospores.

Fig. 6. *Phlebopus colossus* (R. Heim) Singer. A= basidiocarps, B= basidia and basidiospores and C=basidiospores.

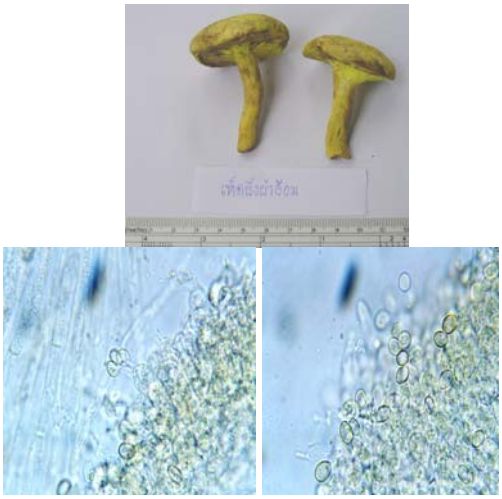

Fig.7. *Pulveroboletus ravenelii* (Berk. & M.A. Curtis) Murril. A= Basidiocarps B= basidia and basidiospores and C=basidiospores.

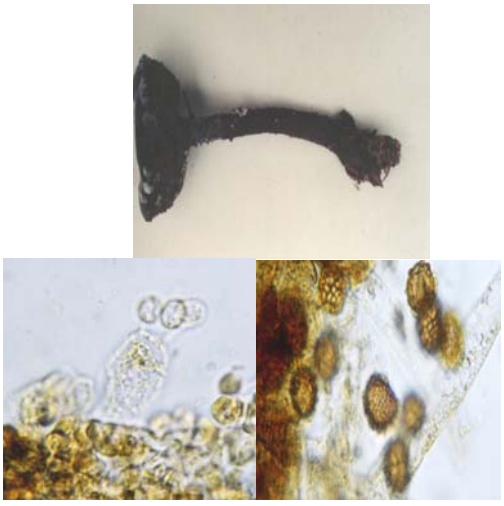

Fig. 8. *Strobilomyces confusus* Singer. A= basidiocarps, B= basidia and basidiospores and C= basidiospores.

Fig. 9. *Strobilomyces floccopus* (Vahl) P.Karst. A= basidiocarps, B= basidia and basidiospores and C= basidiospores.

Discussions

All species described in this paper were collected in the Thailand.These species should be safety to consume as observed in temporary local markets during raining season each year. In Southern Thailand, it is observed that *Boletus griseipurpureus* is widely collected and sold in market at the beginning of rainy season. This mushroom has been reported as mycorrhizal fungus on Cajeput tree or Samed tree (*Melaleuca leucadendron* Corner), Wattle tree (*Acacia auriculiformis* Cunn.), Gustavia (*Gustavia gracillima* Miers.), Eucalyptus tree (*Eucalyptus camaldulensis* Dehn.), and She oak (*Casuarina equisetifolia* Linn.) (Petcharat, 1999). The another one is *Phlebopus colossus* which occasionally found during rainy season and also reported as mycorrhizal fungus (Chansrikul *et al*., 2000). Several species of trees were reported to be the host of *P. colossus* such as *Annona squamosa*, *Elaceocarpus hygrophilus*, *Garcinia schomburgkiana* and *Sesbania javanica* etc. (Chansrikul *et al*., 2000). The other species diversity of Boletes were found in the North of Thailand such as *B. ananas*, *P. colossus* and *S. Floccopus* , Northeast such as *B griseipurpureus*, *H. retispora* , *P. colossus* and *P. ravenelli* and in the South such as *B. emodensis* , *B. griseipurpureus* , *B. nanus* , *P. colossus*, *P. ravenelii*,

S. floccopus and *S. confusus*. *P. colossus* was the most common found in large number and sold in local markets of North, Northeast and South. *B. griseipurpureus* was often found in the area where Eucalyptus tree has been planted of south in Thailand (Petcharat, 1999). The edible boletes that have been reported in Thailand by other mycologist as follows: *B. aestivalis, B. edulis, S. floccopus, S. americanus and S. pictus* (Soytong, 1994).

Table 1. Some wild Boletes collection in this study.

Name	Location
Boletellus ananas	Chaing mai (North)
Boletellus emodensis	Songkhla (South)
Boletus griseipurpureus	Songkhla (South), Sakon nakhon (Northeast)
Boletus nanus	Satun (South)
Heimiella retispora	Sakon nakhon, Ubon Ratchathani (Northeast)
Phlebopus colossus	Chaiyaphum, Ubon Ratchathani (Northeast), Chaing mai (North), Songkhla (South)
Pulveroboletus ravenelli	Sakon nakhon, Ubon Ratchathani (Northeast), Phattalung (South)
Strobilomyces confusus	Songkhla (South)
Strobilomyces floccopus	Chaing mai (North), Songkhla, Trang (South)

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