

Taxonomical Study on the genus *Entoloma* of Korea

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한국산 외대버섯속의 분류학적 연구

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Abstract

The species of the genus *Entoloma* recorded in Korea until now are arranged with Korean *Entoloma* monography. It was made with modified keys of classification of Hesler and Noordeloos. On the basis of it, the genus *Entoloma* of Korea is classified into 7 subgenera, 10 sections, and 80 species.

KEYWORDS : genus, *Entoloma*, monography, keys, Hesler, Noordeloos, subgenera, sections, species.

Carpophores of the genus *Entoloma* varies from small size to large and are habitated all over the world.

Studies on the genus *Entoloma* have been studied by mycologists, which reported 246 species in Europe (Noordeloos, 1992), 200 species in North America (Hesler, 1967), 45 species in Madagascar (Romagnesi, 1941), 225 species in Gabon and Cote D'Ivoire (Romagnesi and Gills, 1978), 234 species in Indomalaya and Australasia (Horak, 1980) and 35 species in Japan (Hongo, 1960).

In Korea, for the first time *Entoloma sinuatum* was reported by Lee and Lee (1957, April). Successively one unrecorded and one recorded species were reported by Lee (1957, November), one unrecorded and one recorded by Lee, Lee and Lim (1959), three recorded by Lim and Kim (1972), one unrecorded and two recorded by Lee and Chung (1972). One unrecorded by Lee (1973), one unrecorded by Hong and Chung (1976), and one recorded by Lee (1976). Three unrecorded were reported by Hong and Chung (1977), one unrecorded by Lee, Kim and Cho (1978), and one unrecorded by Kim, Park, Shin and Hongo (1978).

Ten species were arranged on the basis of published species by *Korean Journal of Mycology* (1978). One unrecorded was reported by Cho and Lee (1980), three recorded by Lee (1981) and one unrecorded by Hong and Shin (1983).

Twelve species were rearranged by Lee and Hong (1985). One unrecorded species was reported by Park, Cho and Lee (1986), nine recorded by Kim and Kim (1980).

Again seventeen species were arranged by Lee (1990). One unrecorded species was reported by Cho and Ryoo (1991), twenty four unrecorded by Cho and Park (1991a, 1991b, 1991c), seven recorded by Park and Lee (1991), fourteen unrecorded by Cho (1992a, 1992b, 1992c), eight unrecorded by Cho and Lee (1992), eight unrecorded by Cho (1993a, 1993b) and seven unrecorded by Cho, Ryoo and Lee (1993).

Singer(1949) proposed to use the *Rhodophyllus* as type genus according to the code of nomenclature of that time, but again Singer(1986) changed the name *Entoloma* as type genus according to the present code of nomenclature.

Hesler's key was arranged according to major microscopic characters. Those species with the stipe eccentric, lateral, or absent, are assembled to form Group I : in the remaining Group(II, III, IV, V), a stipe is present and centrally attached. These Group(II - V) are distinguished by their spore form whether cuboid or polyhedral, and by the presence or absence of lamellar cystidia. Thus, those species with quadrate(cubical) spores comprise Group II ; those in which the spores are 5-sided form the remaining infragene Group, as follows; IV, both pleurocystidia and cheilocystidia are present; V, cheilocystidia only are present.

Nooredloos key was arranged according to habit variable : pleurotoid, omphalioid, mycenoid or tricholomatoid; lamellae variably inserted from free to decurrent with all possible intermediates; spores angular from all views, thin-or relatively thick-walled; spore print pink to pinkish brown; basidia 2 or 4-spored; lamella edge fertile, sterile or heterogenous; cheilocystidia often present; pleurocystidia usually absent; pileipellis a cutis, trichoderm or hymeniderm with all possible intermediates; pigment membranous, in crusting or intracellular, frequently in combinations; pileitrama and hymenophoral trama regular, clamp-connection absent or present.

It was made monography of the genus *Entoloma* with modified classification keys of Hesler(1967) and Noodleos(1987, 1988, 1992). Using it, the species of the genus *Entoloma* were classified into 7 subgenera, 10 sections and 80 species by the author.

Study about the type genus, general characteristics, habitations and microscopic features of Korean *Entoloma* was reported by Cho and Park(1991a).

Key to the genus *Entoloma* of Korea

Key to the genera of Entolomataceae(외대버섯과)

- 1. Spores more or less rough, verruculose or pustulategenus *Rhodocybe*(사마귀버섯속; 신칭)
- 1. Spores angular, at least in polar view
 - 2. Spores smooth and ellipsoid in side view, angular in polar view because of the presence of 3 to 12 longitudinal ridges.genus *Clitopilus*(그늘버섯속)
 - 2. Spores angular in all view, entirely by facets outlined by ridges.genus *Entoloma*(외대버섯속)

Keys to the subgenera of the genus *Entoloma*

- 1. Stipe reduced, excentric or later, ;sometimes lacking.subgen. *Claudopus*(편심외대버섯아속; 신칭)
- 1. Stipe well-developed, usually central, rarely excentric.....2
 - 2. Pileus and/or stipe with blue or violaceous color.3
 - 3. Pileus and stipe with blue or violaceous color.subgen. *Entoloma* (외대버섯아속; 신칭)
 - 3. Above as the same, stipe only with blue or violaceous color.subgen. *Leptonia*(툭니외대버섯아속)
 - 2. Pileus and stipe without blue or violaceous color.4
 - 4. Pileus glabrous, rarely with more or less villose or rugulose center, basidiocarps thin-fleshed, mycenoid; piletrama and hymenophoral trama made up of long, 100-400 μ m long.subgen. *Nolanea*(민꼭지외대버섯아속)
 - 4. Pileus radially fibrillose, tometose or squamulose, rarely glabrous.....5
 - 5. Pileus conical to convex with distinct papilla;clamp connection present.subgen. *Inocephalus*(부녀외대버섯아속; 신칭)
 - 5. Pileus conical to convex with depressed to distinctly umbilicate center, rarely with small papilla but then clamp connection absent.6
 - 6. Pileus pale colored.subgen. *Paraleptonia*(범툭니외대버섯아속; 신칭)
 - 6. Pileus white or with yellow or pink tinges.sugen. *Alboleptonia*(흰툭니외대버섯아속; 신칭)

Key to the species of the subgenus *Claudopus*(편심외대버섯아속)

- 1. Pileus white or greenish white, becoming dull white or yellowish white.*E. mephiticum*(독외대버섯)
- 1. Pileus white, yellowish white when wet, striate.*E. chamaecypris*(삼풀외대버섯)

Key to the section of the subgenus *Entoloma*(외대버섯 아속)

- 1. Pileus large and medium sized.2
 - 2. Pileus convex, dark, blue, violet.sect. *Nitidi*(빛외대버섯 절; 신칭)
 - 2. Pileus viscid, brown, stipe white.3
 - 3. Pileus filamentous hyphae, more or less gelatin.sect. *Entoloma*(외대버섯절; 신칭)
 - 3. Pileus subviscid, olivaceous brown.sect. *Nolandida*(민꼭지외대버섯절; 신칭)
- 1. Pileus small and medium sized.4
 - 4. Pileus white, brown.5
 - 5. Pileus pure white.sect. *Specularii*(창외대버섯 절; 신칭)

- 5. Pileus brown.sect. *Turfosa*(잔디외대버섯 절; 신칭)
- 4. Pileus grayish, darkish, bister brown.6
- 6. Pileus and stipe dark, bister brown, fibrillose or squamulose.sect. *Luctuarii*(홀로외대버섯절; 신칭)
- 6. Pileus grayish, glabrous, robust, striate.sect. *Rhodopolia*(삿갓외대버섯절; 신칭)

Key to the species of the section *Nitidi*(빛외대버섯절)

- 1. Pleurocystidia and cheilocystidia absent.2
- 2. Pileus depressed, or umbilicate at maturity.3
 - 3. Stipe white to gray.*E. umbilicatum*(배꼽외대버섯)
 - 3. Stipe not as above.4
 - 4. Stipe grayish brown.*E. subumbilicatum*(배꼽외대버섯아재비)
 - 4. Stipe paler violet.*E. violaceobrunneum*(황보라외대버섯)
- 2. Pileus convex, often umbonate.*E. cyanoniger*(가지외대버섯)
- 1. Pleurocystidia and/or cheilocystidia present.5
 - 5. Pleurocystidia and cheilocystidia both present.*E. fuliginosum*(흑가루외대버섯)
 - 5. Cheilocystidia only present.6
 - 6. Pileus vinaceous or violaceous.*E. violaceus*(보라꽃외대버섯)
 - 6. Pileus hair brown or mummy brown.*E. peckianum*(흙집외대버섯)

Key to the species of the section *Entoloma*(외대버섯절)

- 1. Pileus umbonate with a papillate, striate.*E. weberi*(거미외대버섯)
- 1. Pileus umbonate, without papillate, not striate.*E. sinuatus*(굽은외대버섯)

Key to the species of the section *Nolandida*(민꼭지외대버섯절)

- 1. Pileus olive-buff, virge.*E. clypratus*(방패외대버섯)
- 1. Pileus not as above color.2
 - 2. Pileus grayish to grayish brown, stipe slender, hollow.*E. rhodopolium*(삿갓외대버섯)
 - 2. Pileus grayish brown, stipe long, solid.*E. crassipes*(외대덧버섯)

Key to the species of the section *Specularii*(창외대버섯절)

- 1. Pleurocystidia and cheilocystidia absent.2
- 2. Pileus depressed or umbilicate at maturity.3
 - 3. Stipe white to pallid.4
 - 4. Pileus white.5
 - 5. Pileus silky, with a small umbo.*E. albidum*(흰색외대버섯)
 - 5. Pileus glabrous without an umbo.*E. murrillii*(오백색외대버섯)
 - 3. Pileus grayish or gray brown.6
 - 6. Pileus becoming scaly, at least over the disc.*E. subplanum*(평평외대버섯아재비)
 - 6. Pileus umbrinous, disc darker.*E. commune*(보통외대버섯)
- 2. Pileus convex, often umbonate.*E. bicolor*(쌍색외대버섯)
- 1. Cheilocystidia only present.*E. peralbidum*(순백외대버섯아재비)

Key to the species of the section *Turofosa*(잔디외대버섯절)

- 1. Pileus depressed or umbilicate at maturity.2
 - 2. Pileus grayish brown, striate, stipe grayish brown.*E. subvile*(안정외대버섯아재비)
 - 2. Pileus brown, stipe whitish*E. prostratum*(원시주름외대버섯)
- 1. Pileus convex, often umbonate.3
 - 3. Pileus ash to gray brown, stipe gray.*E. tephreum*(화산층외대버섯)
 - 3. Pileus grayish brown, stipe whitish gray.*E. lignoputridum*(고목외대버섯)

Key to the species of the section *Luctuarii*(홀로외대버섯절)

- 1. Pleurocystidia and cheilocystidia absent.2
 - 2. Pileus depressed or umbilicate at maturity.3
 - 3. Stipe dingy gray-brown to pinkish brown.*E. subfarinaceum*(가루외대버섯아재비)
 - 3. Stipe horay color.*E. virgnicum*(치녀외대버섯)
 - 2. Pileus convex, often umbonate.*E. grayanum var. grayanum*(회색외대버섯아재비)

Key to the species of the section *Rhodopolia*(삿갓외대버섯절)

- 1. Pileus depressed or umbilicate at maturity.2
 - 2. Stipe white to pallid.3
 - 3. Pileus grayish or gray-brown, glabrous.*E. fumosialbum*(흰연기외대버섯)
 - 3. Pileus pale tawny, umbrinous disc darker.*E. amplifolium*(큰잎외대버섯)
- 1. Pileus convex, often umbonate.5
 - 5. Stipe white, pallid, or grayish white.6
 - 6. Pileus gray-brown, shade of brown.7
 - 7. Pileus not striate.*E. clavipes*(배불뚝이외대버섯)
 - 7. Pileus striate.8
 - 8. Pileus cuticle viscid, from gelatinous hyphae.8
 - 8. Pileus cuticle not gelatinous.*E. sericatum*(섬유비단외대버섯)

Key to the species of the subgenus *Nolanea*(민꼭지외대버섯아속)

- 1. Pileus depressed or umbilicate at maturity.2
 - 2. Pileus fuliginous, darkish, stipe gray.*E. subgriseum*(젓빛외대버섯아재비)
- 2. Pileus and stipe not above.3
 - 3. Pileus yellowish brown, stipe brown.*E. fracturans*(파열외대버섯)
 - 3. Pileus brown with white, stipe white*E. maleolens*(큰렌즈외대버섯)

- 1. Pileus convex, often umbonate.5
- 4. Stipe white, pallid, grayish white.5
- 5. Pileus striate.6
 - 6. Pileus smoky brown to smoky olive, disc darkish silky.7
 - 7. Spores; two-spored.*E. fumosum*(연기의대버섯)
 - 7. Spores; four-spored.*E. fusicodiscum*(검댕이의대버섯)
 - 6. Pileus gray brown, striate when wet.*E. strictius* var. *strictius*(직립의대버섯아재비)
- 5. Pileus not striate.*E. parvipapillatum*(범썩꼭지의대버섯)
- 4. Stipe as not above color.8
- 8. Pileus drab or bister, stipe gray, fuliginous.*E. tortuosum*(굴곡의대버섯)
- 8. Pileus gray, stipe brown, grayish brown.*E. roanense*(양피의대버섯)

Key to the section of the subgenus *Leptonia*(툽니의대버섯아속)

- 1. Clamp connection present.2
- 1. Clamp connection absent.sect. *Cyanula*(청색의대버섯 절)
- 2. Pileus umbonate : cheilocystidia, if present, scattered among basidia, and not very much longer than basidia, cylindrical, clavate or colloid.sect. *Leptonia*(툽니의대버섯절)
- 2. Pileus usually depressed or umbilicate, cheilocystidia if present, very obvious and much longer than basidia or lamellae edges sterile.sect. *Griseorubida*(회색루비의대버섯 절)

Key to the species of the section *Cyanula*(청색의대버섯절)

- 1. Pleurocystidia and cheilocystidia absent.2
- 2. Pileus depressed or umbilicate at maturity.3
 - 3. Stipe gray, brown, or shade of these colors.4
 - 4. Pileus grayish brown, striate-plicate.*E. griseobrunneum*(회갈색의대버섯)
 - 4. Pileus brown to avellaneous.*E. subfloridanum*(꽃송이의대버섯아재비)
- 3. Stipe blue, lilac, murinous or dark.5
 - 5. Pileus striate.6
 - 6. Pileus blue, violet with dark.7
 - 7. Pileus “dark Quker drab”, darkish blue with drab striate from margin to the disc.*E. nigroviolaceum* var. *striatulum*(흑보라줄의대버섯)
 - 7. Pileus darkish blue or darkish violet, margin striate.*E. lazulinus*(흑청색의대버섯)
 - 6. Pileus yellowish brown.*E. scabrosm*(겉겉이의대버섯)
 - 5. Pileus not striate.8
 - 8. Pileus darkish on disc, vinaceous with rosy tint.*E. parvum*(뚝단의대버섯)
 - 8. Pileus context “pale bluish lavender” ...*E. nigroviolaceum* var. *nigroviolaceum*(흑자색의대버섯아재비)
- 2. Pileus convex, often umbonate.9
 - 9. Stipe pale melleous.*E. melleipes*(꿀의대버섯)
 - 9. Stipe bluish brown, darkish brown.*E. anatinum*(민꼬리의대버섯)

- 1. Pleurocystidia and/or cheilocystidia present.10
- 10. Pleurocystidia and cheilocystidia present.*E. squamodiscum*(비듬외대버섯)
- 10. Cheilocystidia only present11
- 11. Pileus depressed or umbilicate.12
- 12. Stipe blue, violaceous, darkish.13
- 13. Pileus striate.*E. serrulatum*(툭니외대버섯)
- 13. Pileus purinose.*E. aethiops* var. *aethiops*(검은비늘외대버섯)
- 12. Stipe grayish brown or grayish blue.14
- 14. Stipe grayish brown.*R. ater*(검은외대버섯)
- 14. Stipe grayish blue.*E. intutum*(햇외대버섯)
- 12. Stipe green brown.*E. incanum*(녹색외대버섯)

Key to the species of the section *Leptonia*(툭니외대버섯절)

- 1. Cheilocystidia only present.*E. lampropum*(빛외대버섯)
- 1. Pleurocystidia and cheilocystidia absent.*E. pungens*(가시외대버섯)

Key to the species of the subgenus *Inocephalus*(부녀외대버섯아속)

- 1. Pleurocystidia and cheilocystidia absent.2
- 2. Pileus umbilicate, brown.*E. cuboideum*(네모외대버섯)
- 2. Pileus papillate, mammillate, or umbonate.3
- 3. Pileus "avellaneous" subzonate : spores 8-10×6.5-8μm, subquadrate.*E. subquadratum*(네모외대버섯아재비)
- 3. Pileus buff or yellowish, not subzonate : spores 9-12×9-11μm, quadrate.*E. ochraceum*(엽초외대버섯)
- 3. Pileus brown, "Brussels brown" to "Verona brown" : spores 10-14×10-13μm*E. spadix*(이삭외대버섯)
- 1. Pleurocystidia and/or cheilocystidia present.4
- 4. Pleurocystidia and cheilocystidia both present.5
- 5. Pileus grayish brown, margin striate when wet.*E. subrombisporum*(연포자의외대버섯)
- 5. Pileus olive-buff, margin even.*E. pallid-olivaceum*(퇴색노랑외대버섯)
- 4. Cheilocystidia only present.6
- 6. Pileus depressed or umbilicate, sometimes scaly.7
- 7. Pileus brown or reddish brown, stipe whitish brown.*E. squamiferrum*(비늘외대버섯)
- 7. Pileus white to pale brownish, stipe beige-brownish.*E. minutoalbum*(애백색외대버섯)
- 6. Pileus convex, often umbonate.8
- 8. Pileus yellow.9
- 9. Pileus yellow, cuspidate-papillate.*R. murraili*(노란꼭지의외대버섯)
- 9. Pileus yellowish with whitish, papillate white.*R. murraili* f. *albus*(흰꼭지의외대버섯)
- 8. Pileus not as above color.10
- 10. Pileus darkish brown.*R. mycenoides*(젓꼭지의외대버섯)
- 10. Pileus salmonous or blue.11
- 11. Pileus "apricot-orange" to "salmon-orange".*R. salmonous*(붉은꼭지의외대버섯)
- 11. Pileus and stipe blue with yellow.*R. aeruginosa*(하늘꼭지의외대버섯)

Key to the species of the subgenus *Paraleptonia* (범톱니외대버섯아속)

- 1. Pleurocystidia and cheilocystidia present.2
 - 2. Pleurocystidia and cheilocystidia both present.*E. dolosum*(여우외대버섯)
 - 2. Cheilocystidia only present.*E. putidum*(냄새외대버섯)
- 1. Pileurocystidia and cheilocystidia absent.3
 - 3. Pileus mammalate, umbo.*E. mammilate*(유방꼭지의대버섯)
 - 3. Pileus depressed or umbilicate.4
 - 4. Pileus brown or yellowish with white.5
 - 5. Pileus brown.*E. sarcitum*(짐외대버섯)
 - 5. Pileus yellow.*E. dunense*(모래외대버섯)
 - 4. Pileus yellowish brown.6
 - 6. Spore heterodiametrical.*R. puchellus*(예쁜외대버섯)
 - 6. Spore nodulose.*E. convexum*(원추외대버섯)

Key to the species of the subgenus *Alboleptonia* (흰톱니외대버섯아속)

- 1. Pleurocystidia and cheilocystidia present.3
 - 3. Pileus depressed or umbilicate.*E. brunneomarginatum*(갈색둘레외대버섯)
 - 3. Pileus convex, often umbonate.*E. sericellum*(비단외대버섯)
- 1. Cheilocystidia only present.*E. albatum*(흰배꼽외대버섯아재비)

摘 要

지금까지 한국에 보고된 외대버섯속의 종을 한국의 외대버섯속을 이용하여 정리하였다. 검색표는 Hesler와 Noordeloos의 분류검색표를 변형하여

만들었다.

그 검색표에 의거 한국의 외대버섯속은 7아속, 10절, 80종으로 분류하였다.

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