

Taxonomic study on Korean Aphylophorales (II) - on some unrecorded species -

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한국산 민주름버섯목의 분류학적 연구 (II)

- 수종 미기록종에 대하여 -

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ABSTRACT: Flesh fungi were collected during field trips to mountain areas throughout the country from May to October of 1994. Through the observation and identification of specimens belonging to the Aphylophorales, one genus, *Tylospora*, and six species, *Athelia fibulata*, *Hypochnicium punctulatum*, *Tylospora fibrillosa*, *Stereum ochraceo-flavum*, *Steccherinum litschaueri*, and *Oligoporus undosus* were confirmed new to Korea and are registered here with descriptions.

KEYWORDS: Taxonomic Study, Unrecorded Fungi, Aphylophorales

From the beginning of May to the end of October in the year 1994, wood-rotting fungi were collected during eleven field trips to eleven mountain areas, Bughan, Chunma, Deogyu, Jijang, Kwanak, Myungji, Seolak, Seonun, Sobaek, and Wolak mountains including Tongdo-sa area, throughout the country. A total of 290 specimens were collected and identified through the observation of morphological and microscopic fruitbody characters. For the observation of specimens, laboratory techniques of Largent *et al.* (1977) and microscopic methods of Jung (1987) were employed.

Total identified fungi belonging to the wood-rotting members of the Aphylophorales amounted to 7 families, 42 genera, and 57 species. Following the first report on the taxonomic study on Korean Aphylophorales

(Jung, 1995), one genus, *Tylospora* of the Corticiaceae, and six more species, *Athelia fibulata*, *Hypochnicium punctulatum*, and *Tylospora fibrillosa* of the Corticiaceae, *Stereum ochraceo-flavum* of the Stereaceae, *Steccherinum litschaueri* of the Hydnaceae, and *Oligoporus undosus* of the Polyporaceae were confirmed new to Korea and are registered here with Korean names and English descriptions.

Taxonomy

For the taxonomy of the Aphylophorales, Donkian concept (1964) was adopted, and the system of Eriksson (1958) and Eriksson *et al.* (1973~1984) was used for the corticioid fungi. The classification of Gilbertson and Ryvardeen (1986~1987, 1993~1994) was employed for polyporoid fungi and the monographic study of Chamuris (1988) for the non-stipitate

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stereoid fungi was referred for stereoid fungi. For other groups of fungi, the colored illustrations of Breitenbach and Kränzlin (1986) and Imazeki *et al.* (1965, 1988, 1989) and the literature of Ito (1955) were very useful for the detailed identification and descriptions of specimens and were frequently consulted for confirmation.

Jung (1994) recently reported the fungal flora of Korean wood-rotting fungi based on the specimens collected from 15 national parks, 7 local areas, and 2 islands for two years from the spring of 1990. In the report, he listed 217 species and 1 variety for the wood-rotting fungi belonging to the Aphylophorales and then, in his first report on the taxonomic study on Korean Aphylophorales (Jung, 1995) published a year later, renewed this list by adding 2 genera and 7 species to it. Including these seven species as well as six unrecorded species counted here, currently confirmed wood-rotting fungi of the Korean Aphylophorales amount to 17 families, 101 genera, 230 species, and 1 variety.

Corticiaceae 고약버섯과

Athelia Pers., emend Donk, *Fungus* 27: 12, 1957 (부후고약버섯속)

Fruitbody annual, resupinate, thin, pellicular, easily separable from substrates; hymenial surface white to whitish, smooth; hyphal system monomitic; hyphae septate with or without clamps, basal hyphae commonly wider and more thick-walled, often encrusted; basidia clavate, with 2~4 sterigmata; basidiospores ellipsoid or cylindrical, smooth, hyaline, inamyloid.

Type species: *Athelia epiphylla* Pers.

Remarks: This genus is one of the commonest taxa in the Corticiaceae and is characterized by the thin pellicular fruitbodies and

the non-amyloid spores. The thin and loose texture makes microscopic characters easy to observe and demonstrate.

1. *Athelia fibulata* M.P. Christ., *Dansk Bot. Ark.* 19: 148, 1960 (조각부후고약버섯, 신칭)

Fruitbody resupinate, effused, confluent, thin, loosely attached to the substrate and detachable in small fragments; hymenial surface white to cream-colored, even, smooth, fissured when dry; margin diffuse, soon bounded.

Hyphal system monomitic; hyphae 2.5~4 μm wide, thin-walled, nodose-septate, loosely interwoven, basal hyphae somewhat wider with slightly thick walls; basidia 20 (~25) \times 4.5~6 μm , slenderly clavate, with 4 sterigmata; basidiospores 6~7.5 (~8) \times 3~4 μm , narrowly to broadly ellipsoid.

Habitat: on the bark of a dead *Quercus*

Remarks: This corticioid fungus is inconspicuous in appearance but is microscopically differentiated by the presence of clamps at all septa and its spores larger than those of other closely related species (Eriksson and Ryvarden, 1973).

Specimens: by the trail between Baekryun Temple and Hyangjuk-bong, Dugyu Mountain, Seolchun-myeon, Muju-gun, Jeonranamdo, SNU 940806-33.

Hypochnicium John Erikss., *Symb. Bot. Ups.* 16: 100, 1958 (후막고약버섯속)

Fruitbody annual, resupinate, effused, adnate; hymenial surface white, whitish, yellowish, or reddish, glabrous or pilose, smooth, tuberculate, or somewhat odontoid; hyphal system monomitic; hyphae septate with clamps, thin- or thick-walled, fibulate; cystidia present or absent; basidia somewhat suburniform, with 4 sterigmata; basidiospores ellipsoid to subglobose, smooth, verruculose, or echinulate, hyaline, thick-walled, cyanophilous.

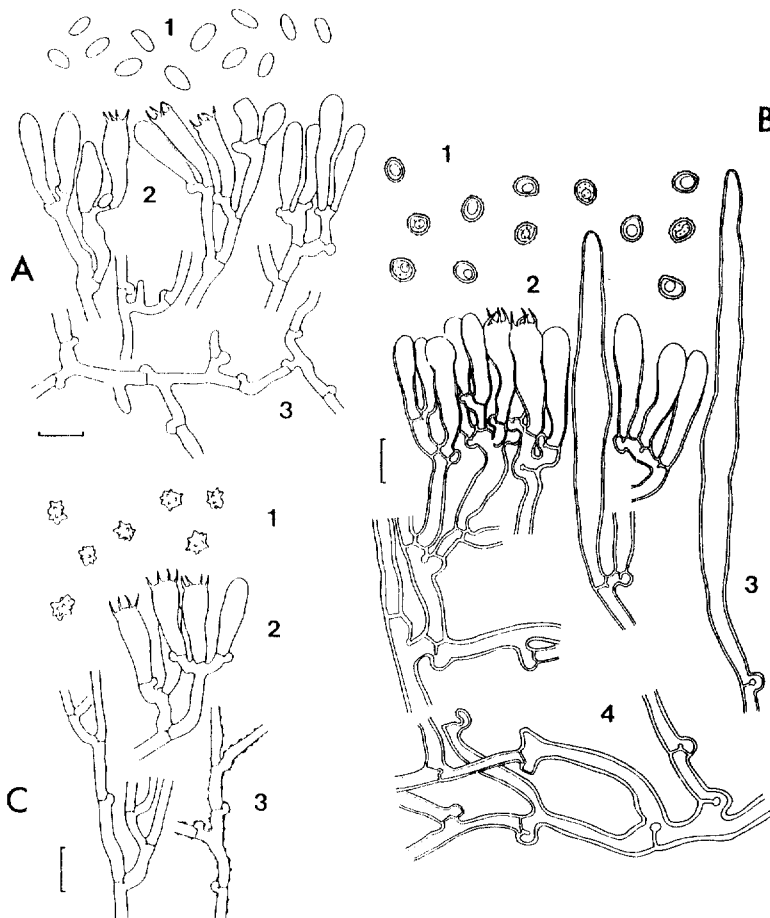


Plate 1. Microscopic structures of unrecorded fungi of the Aphyllophorales (bar=10 μ m)

A. *Athelia fibulata*: 1) basidiospores, 2) basidia, 3) hyphae

B. *Hypochnicium punctulatum*: 1) basidiospores, 2) basidia, 3) cystidia, 4) basal hyphae

C. *Tylospora fibrillosa*: 1) basidiospores, 2) basidia, 3) hyphae

Type species: *Hypochnicium bombycinum* (Sommerf.: Fr.) John Erikss.

Remarks: Unlike *Hyphodontia* and *Hyphoderma*, *Hypochnicium* has thick-walled, smooth to ornamented, and cyanophilous spores and is easily differentiated and identified from its related genera (Eriksson and Ryvar den, 1973).

2. *Hypochnicium punctulatum* (Cooke) John Erikss., *Symb. Bot. Ups.* 16: 101, 1958 (백설후막고약버섯, 신칭)

Fruitbody resupinate, effused, confluent,

thin, less than 0.3 mm thick, pellicular, then subceraceous, adnate; hymenial surface white to cream-colored, at first porous, becoming continuous, smooth or slightly verrucose; margin pruinose, indeterminate or bounded.

Hyphal system monomitic; subhymenial hyphae 4~5 μ m wide, nodose-septate, usually thin-walled, basal hyphae becoming wide up to 8 μ m and thick-walled up to 2 μ m; leptocystidia 60~130 \times 9~12 μ m, common, cylindrical, projecting up to 40 μ m; basidia 25~30 \times 6.5~7.5 μ m, clavate to somewhat ur-

niform, with 4 sterigmata; basidiospores (5~) 6~6.5×4.5~5.5 μm, broadly ellipsoid or subglobose, uniguttulate, finely verrucose.

Habitat: on a dead twig of *Juniperus*; on a dead twig of *Quercus*; on the trunk bark of a dead *Larix*

Remarks: This species is believed to be a rare one and agrees in most respects with published ones, but the SNU specimen also agrees with *H. caucasicum* Parm. with regard to thick-walled basal hyphae and spores of same size and shape (Eriksson and Ryvar-den, 1976).

Specimens: in the woods by the cafeteria of the College of Education, Seoul National University, Gwanak Mountain, Gwanak-gu, Seoul, SNU 940712-3-2; along the wood stairs of the first trail of Chunma Training Camp, Chunma Mountain, Hwado-myeon, Namyangju-gun, Gyunggi-do, SNU 940716-10; along the mountain ridge trail to Jijang-bong, Gwanin-myeon, Pochun-gun, Gyunggi-do, SNU 940730-3.

***Tylospora* Donk, Taxon 9: 220, 1960 (가루고약버섯속, 신칭)**

Fruitbody annual, resupinate, effused, loosely adnate, usually continuous; hymenial surface whitish to cream-colored, smooth or somewhat rough; hyphal system monomitic; hyphae septate with clamps, thin- or somewhat thick-walled, smooth or encrusted, thready; cystidia absent; basidia clavate, with 4 sterigmata; basidiospores triangular or lobed with tubercles, hyaline, inamyloid.

Type species: *Tylospora asterophora* (Bon.) Donk

Remarks: This genus has a characteristic spore morphology which appears rather similar to the species of *Tomentella* and occurs on all kinds of debris on the ground (Hjortstam *et al.*, 1988).

3. *Tylospora fibrillosa* (Burt) Donk, Taxon 9: 220,

1960 (흰가루고약버섯, 신칭)

Fruitbody resupinate, effused, confluent, very thin, loosely attached; hymenial surface white to cream-colored, farinose to continuous; margin finely pruinose, indeterminate.

Hyphal system monomitic; hyphae 2.5~3 μm wide, thin- to rather thick-walled, nodose-septate, some finely encrusted with granules or spinules; basidia 18~20×6 μm, clavate, with 4 sterigmata; basidiospores variable in size, 4.5~5.5 (~6) μm across, irregularly globose to lobed with tubercles.

Habitat: on a fallen twig of an unknown hardwood

Remarks: This fungus is considered as a humus fungus and occurs on all kinds of substrates and is believed to be widely distributed in Northern Europe (Hjortstam *et al.*, 1988). Its frequency of occurrence in Korea waits to be studied.

Specimens: along the mountain ridge trail to Jijang-bong, Gwanin-myeon, Pochun-gun, Gyunggi-do, SNU 940730-6.

Stereaceae 꽃구름버섯과

***Stereum* Persoon, Neues Mag. Bot. 1: 110, 1794 (꽃구름버섯속)**

Fruitbody annual or perennial, effused, effused-reflexed, to pileate, gregarious, confluent, laterally fused to imbricate, coriaceous, tough to hard, thin to thick; upper surface tomentose, zonate; hymenial surface smooth to somewhat tuberculate, bleeding when cut in some species; context thin, dense, usually separated from the tomentum by a narrow brown band (cuticle). Hyphal system monomitic; hyphae thin- to thick-walled, simple-septate, generative hyphae prevalent in the subhymenium and pseudocystidial hyphae prevalent in the context; pseudocystidia arising deep in the trama, yellowish brown, thick-

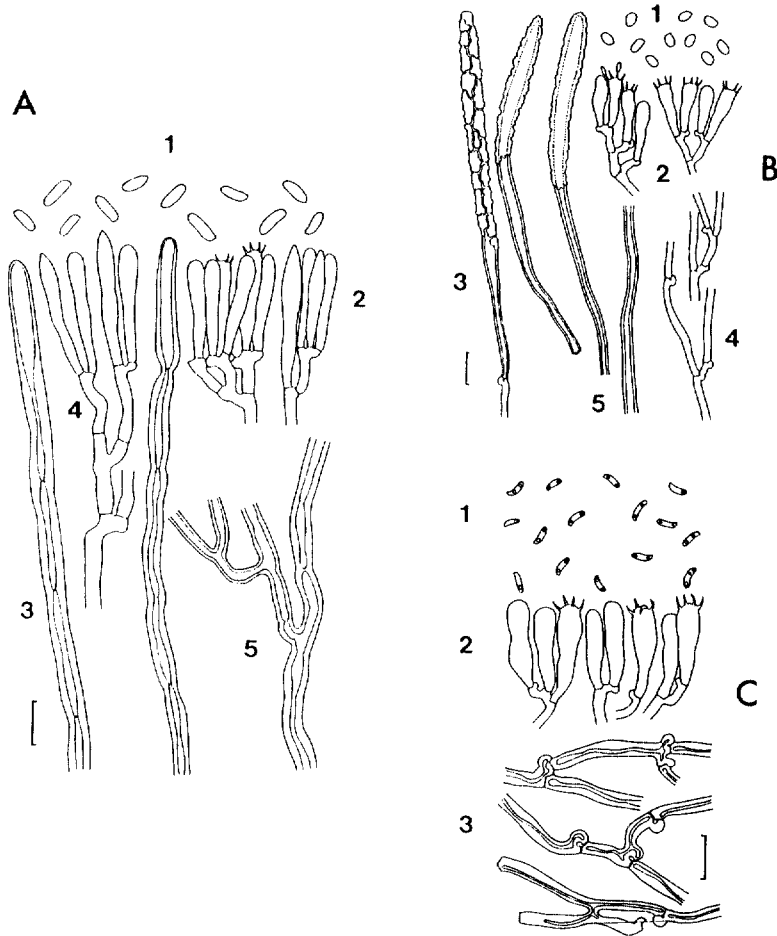


Plate 2. Microscopic structures of unrecorded fungi of the Aphyllophorales (bar=10 μ m)

- A. *Stereum ochraceo-flavum*: 1) basidiospores, 2) basidia, 3) pseudocystidia, 4) acutocystidia, 5) pseudocystidial hyphae
 B. *Steccherinum litschaueri*: 1) basidiospores, 2) basidia, 3) skeletocystidia, 4) generative hyphae, 5) skeletal hyphae
 C. *Oligoporus undosus*: 1) basidiospores, 2) basidia, 3) hyphae

walled, smooth, with oily contents; cystidioles arising in the subhymenium, thin-walled, acute or with apical protuberances; basidia narrowly clavate, with 4 sterigmata; basidiospores narrowly ellipsoid or cylindrical, smooth, hyaline, thin-walled, amyloid.

Type species: *Stereum hirsutum* (Fr.) S.F. Gray

Remarks: This genus is well-defined and most species are cosmopolitan, but species concepts are variable due to the lack of stable

character combinations (Jülich and Stalpers, 1980). Many species are homothallic and probably form microspecies (Eriksson *et al.*, 1984).

4. *Stereum ochraceo-flavum* (Schw.) Ellis, North Amer. Fungi, no. 17, 1878 (배척꽃구름버섯, 신침)

Fruitbody effused-reflexed to sessile, subpileate, initially orbicular, confluent, tough coriaceous; pilei small, usually 1 cm across or so, 0.2~0.4 mm thick, becoming laterally fused; abhymenial surface finely hirsute-tomen-

tose, inconspicuously zoned, whitish ochre to grayish ochre; hymenial surface smooth, circularly undulating or tuberculate where fused, umbonate where attached, somewhat radially uneven, whitish ochre to yellowish ochre; margin entire, sharp.

Hyphal system monomitic with two types of hyphae; generative hyphae 2.5~4 μm wide, simple-septate, thin- to thick-walled, pseudocystidial hyphae 4.5~6 μm wide, aseptate, thick-walled; pseudocystidia arising deep in the trama, 5~7 μm wide, thick-walled, smooth; acutocystidia arising in the subhymenium, 25~35 \times 4~5 μm , thin-walled, acute at the apex; basidia 25~30 \times 4~4.5 μm , narrowly clavate, with 4 sterigmata; basidiospores 6.5~8 \times 2~2.5 μm , narrowly ellipsoid or cylindrical, amyloid.

Habitat : on a dead twig of *Quercus*

Remarks : This fungus has coalescent pilei forming lateral rows and is easily confused with *S. hirsutum*. But the latter species always has an orange ochraceous tint when fresh, a fruitbody at least more than 1 mm thick (Breitenbach and Kränzlin, 1986), and yellow to brown pigments in the tomentum (Chamuris, 1988).

Specimens : along the wood stairs of the first trail of Chunma Training Camp, Chunma Mountain, Hwado-myeon, Namyangju-gun, Gyunggi-do, SNU 940716-8.

Hydnaceae 턱수염버섯과

Steccherinum S.F. Gray, Nat. Arr. Br. Pl. 1: 651, 1821 (바늘버섯속)

Fruitbody annual, resupinate, effused-reflexed, to pileate, membranous; abhymenial surface velutinous to glabrous; hymenial surface odontoid; context whitish, thin. Hyphal system dimitic; generative hyphae hyaline, thin-walled, nodose-septate in most species; skeletal hyphae hyaline, thick-walled, asep-

tate, not branched; skeletocystidia abundant, elongate-clavate, elongate-fusiform, to cylindrical, strongly encrusted; basidia subclavate, with 4 sterigmata; basidiospores ellipsoid, smooth, hyaline, inamyloid.

Type species : *Steccherinum ochraceum* (Pers.: Fr.) S.F. Gray

Remarks : The genus *Steccherinum* is well-characterized by odontoid hymenophores, encrusted cystidia, and small ellipsoid spores. The hyphal system is described as dimitic, but the generative hyphae often merge into thick-walled skeletal hyphae without noticeable changes.

5. *Steccherinum litschaueri* (Bourd. et Galz.) John Erikss. Symb. Bot. Ups. 16: 134, 1958 (흰바늘버섯, 신칭)

Fruitbody resupinate, effused, readily confluent, closely adnate, thin, somewhat membranous when dry; hymenial surface white to cream-colored, odontoid to hydroid, aculei dense, up to 0.8 mm long, subcylindrical, often darker than the hymenium when dry; margin fimbriate to fibrillose.

Hyphal system dimitic; generative hyphae 2~3.5 μm wide, thin-walled, nodose-septate; skeletal hyphae 3~5 μm wide, thick-walled, aseptate; skeletocystidia up to 125 μm long or sometimes more, abundant in aculei, elongate-clavate to cylindrical, widened up to 6~7.5 μm and strongly encrusted in the upper part; basidia 15~18 \times 4.5~5.5 μm , clavate, with 4 sterigmata; basidiospores 4.5~5 (~5.5) \times 3~3.5 μm , ellipsoid to broadly ellipsoid.

Habitat : on a fallen twig of *Acer*

Remarks : This fungus is morphologically confused with odontoid species of *Hypodontia* because of its odontoid appearance of the hymenial surface and must be an uncommon species. The SNU sample has no rhizomorph and its spores are usually rounded into the form of a broad ellipsoid.

Specimens : by the trail between Biro-bong

and Biro-sa, Sobaek Mountain, Punggi-eup, Yeongpung-gun, Gyung-sangbuk-do, SNU 940702-22.

Polyporaceae 구멍장이버섯과

Oligoporus Bref., *Untersuch. Gesamtgebiet. Mykol.* 8: 114, 1888 (손등버섯속)

Fruitbody annual, resupinate, effused-reflexed, to sessile, soft to fleshy, firm to hard when dry; pilei small to medium-sized, narrow, dimidiate, reniform, or subcircular, commonly conchate; upper surface glabrous, pubescent, tomentose, villose, or velutinous, even, uneven, verrucose, to rugose; hymenophore tubular, of small to medium-sized pores; context white or whitish, thin to thick. Hyphal system monomitic; generative hyphae hyaline, thin- to thick-walled, nodose-septate; cystidia or cystidioles present or absent, thin-walled; basidia clavate, with 4 sterigmata; basidiospores allantoid, cylindrical, ellipsoid, to ovoid, smooth, hyaline, sometimes with oil drops, inamyloid.

Type species: *Oligoporus farinosus* Bref.

Remarks: Most members of *Oligoporus* was previously put in *Tyromyces*, but the species of *Oligoporus* cause a brown rot in contrast to the species of *Tyromyces* which cause a white rot.

6. *Oligoporus undosus* (Pk.) Gilbn. et Ryv., *Mycotaxon* 22: 365, 1985 (배척손등버섯, 신침)

Fruitbody resupinate to effused-reflexed, indistinctly reflexed at the upper part with a narrow and tomentose pileus, soft when fresh, firm when dry, adnate; margin narrow, tomentose to fimbriate, becoming entire; hymenophore tubular, pore surface cream-colored, pores 2~4/mm, angular to irregular, with thin and entire to incised dissepiments, tubes whitish, becoming concolorous with the pores, up to 2 mm thick; context white to whitish, fibrous, less than 1 mm thick.

Hyphal system monomitic; generative hyphae densely interwoven, 2~4 μ m wide, nodose-septate, thin-walled to unusually thick-walled with a narrow and sinuous lumen in the trama, commonly septate and branched, flexuose; basidia 20~25 \times 5~5.5 μ m, clavate, with 4 sterigmata; basidiospores 4~5.5 \times 1~1.5 μ m, allantoid.

Habitat: on a dead branch of *Sambucus*

Remarks: This fungus is known to occur primarily on dead conifers (Gilbertson and Ryvarden, 1987), but the present sample was collected from a hardwood. The SNU specimen seems to be a young one and has a rather thin context and shallow tube layers.

Specimens: along the mountain ridge trail to Jijang-bong, Gwanin-myeon, Pochun-gun, Gyunggi-do, SNU 940730-5-1

Conclusion

Total 290 specimens of wood-rotting fungi were collected from eleven mountain areas throughout the country from May to October in 1994 and identified to the species according to recent classification systems. Fungi belonging to the wood-rotting members of the Aphyllophorales amounted to 7 families, 42 genera, and 57 species, and among them, one genus, *Tylospora*, and six species, *Athelia fibulata*, *Hypochnicium punctulatum*, *Tylospora fibrillosa*, *Stereum ochraceo-flavum*, *Steccherinum litschaueri*, and *Oligoporus undosus* were confirmed new to Korea.

When unrecorded fungi of the present study and those of the first report on the taxonomic study on Korean Aphyllophorales are added to the list prepared through the floral study of Korean wood-rotting fungi by Jung, total confirmed wood-rotting fungi of the Korean Aphyllophorales amount to 17 families, 101 genera, 230 species, and 1 variety. The unrecorded species of the study were col-

lected from Gwanak Mountain, Dugyu Mountain, Sobaek Mountain, Jijang-bong, and Chunma Mountain. And *A. fibulata* and *S. ochraceo-flavum* were found on *Quercus*, *S. litschaueri* on *Acer*, *O. undosus*, primarily inhabiting on conifers, on *Sambucus*, *T. fibrillosa*, usually inhabiting on rotten wood and humus, on an unknown hardwood, and *H. punctulatum*, mostly growing on conifers like *Larix* and *Juniperus*, also on a dead twig of *Quercus*.

Among them, *H. punctulatum* and *S. ochraceo-flavum* were collected from Chunma Mountain, Hwado-myeon, Namyangju-gun, Gyunggi-do, and *H. punctulatum*, *T. fibrillosa*, and *O. undosus* from Jijang-bong, Gwanin-myeon, Pochun-gun, Gyunggi-do, from both of which places no surveys had been tried before, and through the present study, diversity and uniqueness of fungal flora from these areas came to be appreciated for the first time. When the previous records of local floral studies were reviewed, a number of floral studies had been reported continuously from Kwangreung area, Jinjup-eup, Namyangju-gun, Gyunggi-do, and judging from the results of the present study, Pochun-gun region and Namyangju-gun region including the Kwangreung area, Gyunggi-do, were also confirmed as very ideal localities for the floral study of the Aphyllophorales.

적 요

1994년 5월부터 1994년 10월까지 도합 11차례에 걸쳐 우리나라 전역의 11개 지역을 탐색하여 290점의 목재부후균류 표본을 확보하고 최근의 분류체계를 따라 자실체의 형태학적인 관찰을 통하여 분류 동정하였다. 그중 가장 많은 종류를 차지하는 종류는 민주름버섯목 균류로서 7과 42속 57종으로 집계되었으며 이들중 도합 1속 6종이 국내 미기록으로 판명되었다. 해당 미기록속은 고약버섯과의 가루고약버섯속(신칭, *Tylospora*)으로 그리고 해당

미기록종은 고약버섯과의 조각부후고약버섯(신칭, *Athelia fibulata*), 백설후막고약버섯(신칭, *Hyphochnium punctulatum*), 흰가루고약버섯(신칭, *Tylospora fibrillosa*), 꽃구름버섯과의 배착꽃구름버섯(신칭, *Stereum ochraceo-flavum*), 수염버섯과의 흰바늘버섯(신칭, *Steccherinum litschaueri*), 그리고 구멍장이버섯과의 배착손등버섯(신칭, *Oligoporus undosus*)으로 동정되었다.

최근 정확성은 한국산 목재부후균류의 분포상에 대한 연구 제 2보를 통하여 국내의 15개 국립공원과 7개 일반 지역 및 2개 도서지역을 탐색한 결과 국내 목재부후균류의 민주름버섯류를 217종과 1변종으로 확인한바 있으며, 이어 균학회지에 게재한 한국산 민주름버섯목의 분류학적 연구 제 1보에서 추가로 발표한 1속 6종 미기록종과 함께 본 연구의 결과를 합산하면 한국산 목재부후 민주름버섯류는 도합 17과 101속 230종 1변종으로 집계되었다. 이들 미기록종 균류는 관악산, 덕유산, 소백산, 지장봉, 및 천마산에서 채집되었으며 섬유부후고약버섯과 배착꽃구름버섯은 참나무, 흰바늘버섯은 단풍나무, 주로 침엽수에 서식하는 배착손등버섯은 딱총나무, 삼림의 부후재목과 부식도에서 발견되는 흰가루고약버섯은 미확인 활엽수, 그리고 낙엽송과 향나무와 같은 침엽수 위주의 숙주에 서식하는 백설후막고약버섯은 참나무와 같은 활엽수에서도 발견되었다.

그중 백설후막고약버섯과 배착꽃구름버섯은 경기도 남양주군 화도면 천마산에서 그리고 백설후막고약버섯과 흰가루고약버섯 및 배착손등버섯은 경기도 포천군 관인면 지장봉에서 채집되었는데 이들 지역은 그간 균류조사의 미답지였으며 본 연구를 통하여 이들 지역의 균류 분포상의 다양성과 특이성을 처음으로 알수있었다. 과거에 조사된 균류의 분포 기록을 참조하여 볼 때 경기도 남양주군 진접읍 광릉 일대에서 다양한 균류상이 계속적으로 보고되어 왔는데 금번 조사를 통하여 경기도 포천군과 광릉 지역을 포함한 남양주군 일대가 민주름버섯류의 분포상 연구에도 매우 이상적인 지역으로 확인되었다.

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