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Taxonomic study on Korean Aphyllophorales (IV)
- on some unrecorded wood-rotting fungi -

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한국산 민주름버섯목의 분류학적 연구 (IV)
-수종 미기록 목재부후균류에 대하여-

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ABSTRACT: Wood-rotting fungi of the Aphyllophorales were collected through field trips to mountain areas of the country from January to December of 1997. Through the observation and identification of specimens, two genera, *Meruliopsis* (type species = *M. taxicola*) and *Pseudomerulius* (type species = *P. aureus*), and four species, *Phanerochaete calotricha, Phanerochaete chrysorhiza, Meruliopsis corium*, and *Pseudomerulius aureus* were confirmed as new wood-rotting fungi to Korea and are registered here with descriptions.

KEYWORDS: Aphyllophorales, Unrecorded fungi

During the period from January to December of 1997, fresh fungi were surveyed and collected through 35 field trips to seven national parks, one provincial park, one county park, two national tourist resorts, two local areas, five Kyunggi areas, and four suburban metropolitan areas throughout the country from January to December of 1997. Through periodical collection trips, 550 specimens of higher fungi were collected, among which more than four fifths of specimens belonged to the Aphyllophorales of the Basidiomycota were technically examined. Systematic and taxonomic studies on collected materials were then carried out to discover unrecorded or native species of Korean wood-rotting Aphyllophorales.

In result, about 100 taxa of the Basidiomycota were temporarily identified to the species through the observation of morphological and microscopic structures of basidiocarps. For the observation of specimens, laboratory techniques of Largent *et al.* (1977) and microscopic methods of Jung (1987) were employed. Following the third report on the taxonomic study on Korean Aphyllophorales (Jung, 1996), two genera, which were *Meruliopsis* (type species: *M. taxicola*) and *Pseudomerulius* (type species: *P. aureus*), and four species, which were *Phanerochaete calotricha, Phanerochaete chrysorhiza*, and *Meruliopsis corium* of the Corticiaceae, and *Pseudomerulius aureus* of the Coniophoraceae were confirmed as new wood-rotting fungi to Korea and are registered here with Korean names and English descriptions.

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Taxonomy

For the taxonomy of the Aphyllophorales, Donkian concept (1964) was adopted, and the classification system of Eriksson (1958) and Eriksson *et al.* (1973-1984) and the systematics of Parmasto (1968) were referred for the corticioid fungi of the present study. And the memoir of Ginns and Lefebvre (1993) was consulted for merulioid and coniophoroid fungi. The colored illustrations of Breitenbach and Kränzlin (1986) and the description keys of Jülich and Stalpers (1980) were very useful for the detailed descriptions of specimens and were frequently consulted for identification.

Jung (1994) once 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 98 genera, 217 species, and 1 variety for the wood-rotting fungal flora belonging to the Aphyllophorales. And then, in his first to third reports (Jung, 1995, 1996a, 1996b) for the taxonomic studies on the Korean Aphyllophorales published in series, he renewed the previous list by adding 2 genera 7 species, 1 genus 6 species, and 1 genus 6 species respectively. Including above-listed 4 genera and 19 species as well as 2 unrecorded genera and 4 unrecorded

species counted here, currently confirmed wood-rotting fungi of the Korean Aphyllophorales amount to 17 families, 104 genera, 240 species, and 1 variety.

Corticiaceae 고약버섯과

***Phanerochaete* Karst., Krit. Öfvers. Finl. Basidsv. p. 426, 1893 유색고약버섯속**

Fruitbody annual, resupinate, usually soft when fresh, membranous when dry, more or less detachable, vivid and various in color; hymenial surface smooth or tuberculate; margin fimbriate, fringy, or sometimes rhizomorphic; hyphal system monomitic, hyphae distinct, subhymenial hyphae simple-septate, thin-walled, richly branched, intertwined, subicular hyphae occasionally nodose-septate, thick-walled, infrequently branched, and straight; cystidia usually conspicuous and numerous, varying in shape and nature; basidia narrowly clavate, with 4 sterigmata; basidiospores narrowly ellipsoid to allantoid, smooth, not amyloid.

Type species: *Phanerochaete velutina* (Fr.) Karst.

Remarks: *Phanerochaete* is rather easily recognized both macroscopically and microscopically by its bright color of fruitbodies, frequent to numerous distinct cystidia, and thick-walled subicular hyphae with occasional conspicuous clamps.

1. *Phanerochaete calotricha* (Karst.) Erikss. et Ryv., Cort. N. Europe 5: 997, 1978 깃털유색고약버섯 (신칭)

Fruitbody resupinate, effused, confluent, membranaceous, more or less detachable, thin, less than 0.3 mm thick; hymenial surface white, then turning yellowish or pale ochraceous, smooth, somewhat cracking on drying; margin variable but often partly fibrillose and with whitish rhizomorphs.

Hyphal system monomitic; subhymenial hyphae simple-septate, thin-walled, 2-3 μm wide, richly and irregularly branched; subicular hyphae infrequently nodose-septate, somewhat thick-walled, 4-6 μm wide, sometimes up to 10 μm wide, sparsely branched, somewhat horizontally arranged; cystidia abundant, more or less subulate, 43-51×4-6 μm, commonly projecting; basidia narrowly clavate, without basal clamp, 23-26×4-6 μm, with 4 sterigmata; basidiospores narrowly ellipsoid, straight or adaxially somewhat convex, 3.8-4×2-2.2 μm, smooth, generally with two oil-drops, inamyloid.

Habitat: on a fallen twig of an unknown hardwood

Remarks: This fungus develops whitish rhizomorphs from the fibrillose margin and, microscopically, has numerous subulate cystidia. It is often treated as a pale form of *P. sanguinea* (Burdsall, 1985) but, as the color used to be a steady character in *Phanerochaete*, it would be better to treat this species as a separate taxon of its own. The SNU specimen has somewhat smaller spores than those in literature (Eriksson *et al.*, 1978).

Specimens: Naerang-ri, Gunwi, Gunwi-gun, Gyungsangbug-do, SNU 970918-2.

2. *Phanerochaete chrysorhiza* (Torrey in Eaton) Budington et Gilbertson, Southw. Natur. 17: 417, 1973 침유색고약버섯 (신칭)

Fruitbody resupinate, effused, thin, becoming membranaceous, easily separable; hymenial surface reddish orange, hydnaceous, spines up to 1.2 mm long, subulate to cylindrical with a tapering apex; margin orange white, fibrillose to rhizomorphic with well-developed cordons up to 1 mm thick.

Hyphal system monomitic; subhymenial hyphae simple-septate, thin-walled, 3-5 μm wide, frequently branched; subicular hyphae mostly simple-septate, occasionally nodose-septate, thick-walled, 4-7 μm, frequently branched usually at right angles, commonly encrusted with hyaline crystals; cystidia common, usually ventricose, 15-40×4-6 μm, commonly projecting; basidia clavate, without basal clamp, 17-21×4-4.5 μm, with 4 sterigmata; basidiospores ellipsoid to narrowly ellipsoid, adaxially slightly flattened, 3.5-4×2-2.5 μm, smooth, inamyloid.

Habitat: on a fallen twig of an unknown hardwood

Remarks: Due to the conspicuous orange fruitbody with subulate spines and rhizomorphic cordons, this fungus is easily identified with the naked eye. Microscopically, it has encrusted hyphae, leptocystidia, and spores typical of the genus *Phanerochaete*.

Specimens: Daemo-san, Ilweon-dong, Kangnam-gu, Seoul, SNU 970830-21.

Meruliaceae 아교버섯과

***Meruliopsis* Bond. apud Parm., Eesti NSV Tead. Akad. Toimet. Biol. seer. 8: 274, 1959 가죽아교버섯속**

Fruitbody annual, resupinate, effused, effused-reflexed, to slightly pileate, membranaceous; hymenial surface whitish to ochraceous, even, becoming merulioid; hyphal system monomitic; hyphae simple-septate, thin- to somewhat thick-walled; cystidia sometimes present, cylindrical; basidia narrowly clavate, with 4 sterigmata; basidiospores cylindrical to narrowly ellipsoid, smooth, hyaline, inamyloid.

Type species: *Meruliopsis taxicola* (Per.) Bond. apud Parm.

Remarks: According to Jülich and Stalpers (1980), this genus is synonymous with genera *Byssomerulius* and *Ceraceomerulius*. It has a typical merulioid hymenium and several characters that agree with the genus *Phanero-*

chaete in nature of hyphae, basidia, and spores (Eriksson and Ryvarden, 1973).

3. *Meruliopsis corium* (Fr.) Ginns, Canad. J. Bot. 54: 126, 1976 흰가죽아교버섯 (신칭)

Fruitbody resupinate, effused-reflexed to somewhat semipileate, growing in patches, 0.5-1 mm thick, membranaceous; pilei projecting outward to the side, forming narrow and continuous edges; upper surface whitish to creamish, fibrillose-tomentose, inconspicuously zoned; lower surface whitish to ocherish, initially smooth, then reticulate-poroid to merulioid, verrucose; margin finely byssoid; texture leathery membranaceous, rather tough.

Hyphal system monomitic; generative hyphae simple-septate, thin- to thick-walled, 2.5-4.5 μm wide, commonly branched and intertwined; cystidia none; basidia slenderly clavate, without basal clamp, 25-30×4-6 μm, with 4 sterigmata; basidiospores narrowly ellipsoid, 4-5×2-3 μm, smooth, inamyloid.

Habitat: on a fallen twig of *Prunus sargentii*

Remarks: This species is called *Byssomerulius corium* depending on authors (Eriksson and Ryvarden, 1973). Its fruitbody is rather various from resupinate to semipileate forms in shape but is very simple and has no particular characters under the microscope. Its relationship with other merulioid fungi is uncertain but the species is placed in the Meruliaceae for the present (Imazeki *et al.*, 1988).

Specimens: Naerang-ri, Gunwi, Gunwi-gun, Gyungsangbug-do, SNU 970918-1

Coniophoraceae 버짐버섯과

***Pseudomerulius* Jül., Persoonia 10(3): 330, 1979 주름버짐버섯속**

Fruitbody annual, resupinate, effused to effused-reflexed, adnate to separable, soft and ceraceous when fresh, firm and brittle when dry; hymenial surface yellow to yellow brown, darkening with time, merulioid; hyphal system monomitic; hyphae nodose-septate, richly branched or densely united; cystidia absent; basidia clavate, usually with 4 sterigmata; basidiospores cylindrical, smooth, somewhat colored, with thickening walls, inamyloid, cyanophilous.

Type species: *Pseudomerulius aureus* (Fr.) Jül.

Remarks: *Pseudomerulius* has an irregularly netted hymenophore and is closely related to *Leucogyrophana* in sharing colored and cyanophilous spores of thickening walls and leaving too small differences to differentiate from the latter genus (Eriksson *et al.*, 1981).

4. *Pseudomerulius aureus* (Fr.) Jül. Persoonia 10(3): 330, 1979 주름버짐버섯 (신칭)

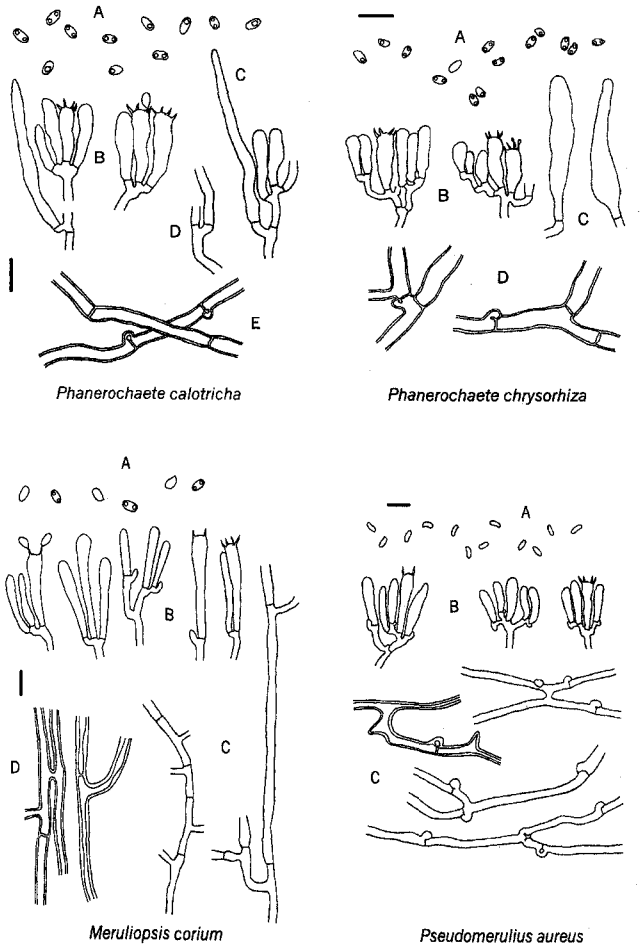

Fig. 1. Microscopic structures of unrecorded wood-rotting fungi (bar = 10 μm). *Phanerochaete calotricha*: A) basidiospores, B) basidia, C) cystidia, D) subhymenial hyphae, E) subicular hyphae. *Phanerochaete chrysorhiza*: A) basidiospores, B) basidia, C) cystidia, D) subicular hyphae. *Meruliopsis corium*: A) basidiospores, B) basidia, C and D) generative hyphae. *Pseudomerulius aureus*: A) basidiospores, B) basidia, C) generative hyphae.

Fruitbody resupinate, effused or partly reflexed, about 1 mm thick, adnate, becoming loosely attached and separable on drying, orbicular, often confluent; hymenial surface yellow, yellow orange, or yellow brown, becoming dark on touching or aging, irregularly folded into a net of composed pores, pores 1-2 mm wide; margin distinct, white or yellow, narrow.

Hyphal system monomitic; hyphae nodose-septate, thin-walled, somewhat thick-walled in the subiculum, 2-3 μm wide in the subhymenium, 3-5 μm wide in the subiculum, richly branched; cystidia none; basidia clavate, with basal clamp, 15-20×4-5 μm, with 4 sterigmata; basidiospores cylindrical, adaxially straight or slightly curved, 3-3.5×1.5 μm, smooth, cyanophilic, inamyloid.

Habitat: on a fallen twig of *Pinus densiflora*

Remarks: This fungus is easily recognized because of its brightly colored fruitbody and irregularly composed

pores in the field. Ampullate clamps and cyanophilous spores are helpful characters under the microscope. Basidiospores of the SNU specimen are rather small, compared with those in literature of Eriksson *et al.* (1981).

Specimens: Wang-san, Wangsan-ri, Mohyun-myeon, Yongin, Kyunggi-do, SNU 970927-4

Conclusion

From seven national parks, one provincial and one county parks, two national tourist and two local areas, and five Kyunggi and four suburban areas throughout the country, total 550 specimens of higher fungi were regularly searched and collected from January to December of 1997 and identified to the species according to recent classification systems. Fungi belonging to the Aphyllophorales of the Basidiomycotina which took more than four fifths of collections were systematically studied for the discovery of unrecorded or native species of Korean wood-rotting Aphyllophorales.

Among identified species, two genera, *Meruliopsis* and *Pseudomerulius*, and four species, *Phanerochaete calotricha, Phanerochaete chrysorhiza, Meruliopsis corium*, and *Pseudomerulius aureus* were confirmed as new taxa to Korea. When unrecorded fungi of the first to third reports on the taxonomic study on Korean Aphyllophorales published in 1995 and 1996 and those of the present study are added to the list prepared by Jung through the second fungal floral study of Korean wood-rotting fungi in 1994, total confirmed wood-rotting fungi of the Korean Aphyllophorales amount to 17 families, 104 genera, 240 species, and 1 variety.

The unrecorded species of the present study were collected from Naerang-ri, Daemo-san, and Wang-san. Among them, *Phanerochaete calotricha* and *P. chrysorhiza* were found on unknown hardwoods, *Meruliopsis corium* on *Prunus sargentii,* and *Pseudomerulius aureus* on *Pinus densiflora*. Two species were collected from Naerang-ri of Gyungsangbug-do and two other species from the suburbs of Seoul like Daemo-san and Wang-san. Although there had been no fungal surveys from Gunwi area before and the area had been polluted by local industries, Gunwi area seemed to have a unique fungal flora of its own and, following the third report of Jung (1996), Seoul and its surrounding areas of Kyunggi Province again showed a variety of fungal flora. Gunwi and Seoul areas were apparently suitable localities for the floral study of the Aphyllophorales in relation to the industrial pollution.

적 요

1997년 1월부터 12월까지 12개월 동안 우리나라의 중부와 남부의 전역을 통하여 민주름버섯류의 분포가 다양한 국내 산림지역을 중심으로 도합 35회에 걸쳐 계룡산, 북한산, 설악산, 소백산, 속리산, 오대산, 치악산 국립공원, 강천산 군립공원, 모악산 도립공원, 공릉 및 마니산 국민관광지, 내량리 및 광덕산 일반지역, 적목리, 명지산, 수락산, 왕산, 봉화산 경기도 일대, 그리고 관악산, 대모산, 서삼릉, 서오릉 일대의 서울시 근교를 위시한 우리나라의 전역을 중심으로 정기적인 균류 탐색과 채집을 실시하여 550점의 표본을 채집하고 이들 균류의 국내 분포상을 조사하면서 국내 민주름버섯류의 미기록종과 고유종의 발굴을 수행하였다.

동정된 균류중 2속 4종은 국내 미기록균류로 확인되었으며 해당 미기록속을 열거하면 *Meruliopsis*(기준종 = *M. taxicola*; 가죽아교버섯속, 신칭)와 *Pseudomerulius*(기준종 = *P. aureus*; 주름버짐버섯속, 신칭)이며, 해당 미기록종을 열거하면 고약버섯과의 *Phanerochaete calotricha*(깃털유색고약버섯, 신칭)와 *Phanerochaete chrysorhiza*(침유색고약버섯, 신칭), 아교버섯과의 *Meruliopsis corium*(흰가죽아교버섯, 신칭), 및 버짐버섯과의 *Pseudomerulius aureus*(주름버짐버섯, 신칭)이다.

1994년 정학성은 한국산 목재부후균류의 분포상에 대한 연구 제 2보를 통하여 국내 목재부후균류의 민주름버섯류를 98속 217종 1변종으로 확인한바 있으며, 이어 1995년도에 게재한 한국산 민주름버섯목의 분류학적 연구 제 I보에서 발표한 2속 7종 미기록균류와 1996년도에 게재한 제 II보에서 발표한 1속 6종 미기록균류 및 제 III보에서 발표한 1속 6종 미기록균류와 함께 본 연구에서 확인된 2속 4종 미기록균류를 합산하면 한국산 목재부후 민주름버섯류는 도합 17과 104속 240종 1변종으로 집계되었다. 이들 미기록종 균류는 내량리, 대모산, 및 왕산에서 채집되었으며, 이들중 깃털유색고약버섯과 침유색고약버섯은 미확인 활엽수, 흰가죽아교버섯은 산벚나무, 및 주름버짐버섯은 소나무에서 발견되었다. 군위 지역은 과거의 균류조사 기록의 부재와 지방 산업으로 인한 공해에도 불구하고 지역 특유의 균류 분포상을 지닌 것으로 보이며, 서울과 서울 근교는 정학성(1996)의 제 III보에서 지적한 바와 같이 다양하고 특이한 균류 분포상을 지니고 있는 점으로 미루어 군위 지역과 서울을 위시한 서울 근교 일대는 산업 공해와 관련하여 민주름버섯류의 분포상 연구에 매우 적합한 지역으로 판단된다.

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