

Unrecorded Higher Fungi of the Songnisan National Park

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Fresh mushrooms were collected during survey field trips to the southern areas of Songnisan National Park for 24 days from April to November in 2002. Through this investigation, a total of 682 fungal collections were obtained and taxonomically amounted to 5 classes, 14 orders, 44 families and 202 species. Among them, six genera *Diplomitoporus*, *Heterochaete*, *Hydnochaete*, *Loweporus*, *Scytinostroma* and *Tomentellina*, and twelve species, *Asterostroma cervicolor*, *Diplomitoporus crustulinus*, *Fomitopsis cajanderi*, *Heterochaete delicata*, *Hydnochaete tabacinoides*, *Hyphodontia sambuci*, *Hypoxylon deustum*, *Lopharia cinerascens*, *Loweporus roseoalbus*, *Phanerochaete chrysosporium*, *Scytinostroma odoratum* and *Tomentellina fibrosa* were confirmed as new to Korea and registered here with descriptions.

KEYWORDS: Higher fungi, Songnisan, Unrecorded species

The Songnisan National Park lies on the boundary between Chungcheongbuk-do and Gyeongsangbuk-do, central part of the Baekdudaegan mountain ranges, and bridges northern and southern ecosystems of the Korean Peninsula. Chonhwangbong (1,057 m), highest peak of the park, is the water source of three rivers, Han-gang River, Geum-gang River and Nakdong-gang River. Songnisan has a typical continental climate with four distinct seasons. Winters are usually long, cold and dry, whereas summers are short, hot and humid. Temperature average is around 10.7°C throughout the year and precipitation amounts 1,262 mm per year. Songnisan has a complex formation of forests on slopes and ridges and the entire park is dotted with pine forests and densely forested with broadleaved trees everywhere. There are also rare plants such as Korean *Berchemia* (white forsythia) and red pine that are designated as natural monuments of the country.

The Songnisan National Park has a good forest formation and an adequate environment for fungal growth, but until recently, there have been rare floral studies on fungi in this park area and the information on fungal flora has been wanted. As a part of the National Park Natural Resources Investigation promoted by the National Park Authority, regular field trips were made to this park area and fresh fungal specimens were collected from the selected southern areas of the national park through field surveys for 24 days from April to November in 2002. A total of 682 fungal collections were obtained and all specimens were taxonomically identified to the species through observation of morphological and microscopic characters and, among them, twelve species were identified as unrecorded species of Korea.

Materials and Methods

Fresh fungi were collected from the Songnisan National Park from April to November in 2002. Regular and planned survey trips were conducted, careful field records were made for habitats, hosts, substrates, and photographs were taken for collecting sites and fruitbodies. Latitude variation of collecting sites was always checked using a GPS system (eTrex Venture, England). A total of 682 fungal collections obtained in the field were brought to the laboratory and completely dried using a warm dryer. All specimens dried and observed were deposited in the herbarium of SFC (Seoul National University Fungus Collection). For the description of specimens, sections were mounted in 3% KOH and mildly heated to rehydrate dry tissues and dissolve crystalline mass away for better observation (Jung, 1987). Prepared sections were treated with 1% phloxine to stain tissue and preserve for later observation. Microscopic characters were sketched using a drawing tube and more than 10 measurements were made for each character for the description of average dimensions.

Taxonomy. For the general taxonomy and descriptions of identified taxa, the system of Dennis (1981) was followed for the ascomycetous fungi, the classification of McNabb (1973) was employed for the auriculariaceous fungi, the key of Dring (1973) was used for the gasteromycetous fungi, the system of Singer (1986) was applied for the Agaricales, and Donkian concept (Donk, 1964) was adopted for the Aphyllophorales. The classification system of Eriksson (1958), Eriksson and Ryvarden (1973-1976), Eriksson *et al.* (1978-1984) and the systematics of Parmasto (1968) were referred for corticioid fungi. Stud-

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ies of Gilbertson and Ryvarden (1986, 1987), Ryvarden and Gilbertson (1993, 1994) and Ryvarden and Johansen (1980) were referred for polypores and the study of Lim and Jung (1999) was consulted for *Stereum*. Illustrations of Breitenbach and Kränlin (1984~2000), Imazeki and Hongo (1965, 1989) and Imazeki *et al.* (1988) were frequently looked up for general fungi. For the search of the higher fungal flora, Jung (1992, 1993a, b, 1994a, b, 1995a, b, 1996a, b), Lim *et al.* (1999), Lim and Jung (2000, 2001) and Lee *et al.* (2002) were consulted. To follow modern systematics, latest scientific names have been tried as much as possible. Recent classification keys have been referred but possible differences in morphological characters between Korean and foreign higher fungi were always taken into consideration in identification of species.

Through this investigation, a total of 682 fungal collections were obtained and all specimens were identified to the species. They were classified into 5 classes, 14 orders, 44 families and 202 species. Among them, six genera, *Diplomitoporus*, *Heterochaete*, *Hydnochaete*, *Loweporus*, *Scytinostroma* and *Tomentellina*, were identified as unrecorded taxa and twelve species, *Asterostroma cervicolor*, *Diplomitoporus crustulinus*, *Fomitopsis cajanderi*, *Heterochaete delicata*, *Hydnochaete tabacinoides*, *Hyphodontia sambuci*, *Hypoxylon deustum*, *Lopharia cinerascens*, *Loweporus roseoalbus*, *Phanerochaete chrysosporium*, *Scytinostroma odoratum* and *Tomentellina fibrosa*, were confirmed as new to Korea and registered here with descriptions.

Family Xylariaceae 콩꼬투리버섯과

Hypoxylon deustum (Hoffm.) Grev., Flora Edinensis: pl. 324, Fig. 2 (1828) 껍질방석꼬투리버섯(신칭) = *Ustulina deusta* (Fr.) Petrak (Figs. 1-1, 2-1)

Ascomycetes gray-yellowish, forming a black brittle crust, several cm across; surface undulating-tuberculate with black perithecia; perithecia 1 mm across, ostiolate.

Asci eight-spored; paraphyses filiform, 2 μ m wide; ascospores uniseriate, elliptical, rather flattened at one side, with 3~4 drops, 40~42 \times 12~14 μ m, dark-brown, with a germination cleft.

Specimen examined: SFC 020405-21

Habitat: on the base of *Quercus mongolica*

Family Exidiaceae 쯤목이과

Heterochaete Pat., in Patouillard & Lagerheim, Bull. Soc. Mycol. Fr. 8: 120 (1892) 들기목이속(신칭)

Heterochaete delicata (Klotzsch ex Berk.) Bres., Hedwigia, Beibl. 53 (1-2): 77 (1913) 미세들기목이(신칭) (Figs. 1-2, 2-2)

Basidiocarps resupinate, confluent to form continuous expanses, readily separable from substratum when old, cream-colored, greenish when symbiotic with algae, dis-

tinct at margin; surface finely tomentose; consistency waxy.

Hyphal system dimitic; generative hyphae septate with clamps; skeletal hyphae 1.6~3.6 μ m wide; basidia 4-celled by longitudinal septa, with long sterigmata of 25~30 \times 2~2.5 μ m; basidiospores elliptical to cylindrical with several drops, 7.2~9.8 \times 3.8~4.6 μ m.

Specimens examined: SFC 020826-40, 021123-12

Habitat: on fallen branches of *Ulmus davidiana*

Family Corticiaceae 고약버섯과

Hyphodontia sambuci (Pers.) J. Erikss., Symb. Bot. Upsal. 16 (1): 104 (1958) 석회돌기고약버섯(신칭) = *Lyomyces sambuci* (Pers.: Fr.) Karst. (Figs. 1-3, 2-3)

Basidiocarps resupinate, confluent to form continuous expanses, white or creamish white, resembling white paint, attached tightly to the substrate, distinctly bounded at margin; surface dull, somewhat fissured when dry; consistency crustose like whitewash.

Hyphal system monomitic; hyphae septate with clamps, 1.8~3 μ m wide; cystidia cylindrical, capitate, 24 \times 3.5 μ m with septa and clamps; basidia clavate, 18~23 \times 5~8 μ m; basidiospores oval, 4.6~4.8 \times 3.4~4 μ m.

Specimen examined: SFC 020515-03

Habitat: On the branch of a hardwood

Phanerochaete chrysosporium Burds., in Burdsall & Eslyn, Mycotaxon 1 (2): 124 (1974) 무성유색고약버섯(신칭) (Figs. 1-4, 2-4)

Basidiocarps resupinate, effused, confluent to form continuous expanses, gray-blue; surface coarsely smooth, furrowed when dry; margin usually distinct; consistency waxy.

Hyphal system monomitic; hyphae septate without clamps, richly branched, thick-walled at the basal part, 5~6 μ m wide; cystidia fusiform to cylindrical, 100~110 \times 7~11 μ m; basidia narrowly clavate, 20~45 \times 4~5 μ m; basidiospores elliptical, 5.4~7.2 \times 3.4~4 μ m, with one or more oil drops.

Specimen examined: SFC 020417-14

Habitat: on the fallen branch of *Quercus variabilis*

Scytinostroma Donk, Fungus, Wageningen 26: 19 (1956) 기질고약버섯속(신칭)

Scytinostroma odoratum (Fr.) Donk, Fungus, Wageningen 26: 20 (1956) 흰기질고약버섯(신칭) (Figs. 1-5, 2-5)

Basidiocarps fully resupinate, forming continuous expanses, attached tightly, distinct at margin; surface smooth, finely tomentose, dull, whitish to pale yellowish brown; texture membranous, waxy.

Hyphal system dimitic; generative hyphae without clamps; skeletal hyphae dichotomously branched, 1.5 μ m wide, curled, closed; gloeocystidia clavate to fusiform; basidiospores elliptical, smooth, hyaline, 5.8~7.2 (~9.4) \times 3.2~

3.8 (~4.2) μm , thin-walled, smooth.

Specimen examined: SFC 020417-11

Habitat: on the base of dead *Pinus rigida*

Family Hymenochaetaceae 소나무비늘버섯과

Asterostroma cervicolor (Berk. & M.A. Curtis) Masee, J. Linn. Soc. Bot. 25: 155 (1889) 별소나무무늬버섯 (신칭) (Figs. 1-6, 2-6)

Basidiocarps fully resupinate, confluent to form continuous patches, loosely attached to the substrate, yellow to brown; surface smooth to finely tomentose; margin filamentous in parts; texture cottony.

Hyphal system monomitic; hyphae septate without clamps, 1.5~3 μm wide; asterosetae stellate, thick-walled, light brown, up to 123 μm long, with 4~5 branches, sometimes dichotomously branched, 2~5 μm across; cystidia fusiform, thin-walled, 48~52 \times 10~13 μm ; basidia cylindrical to ventricose, 40~50 \times 5~8 μm ; basidiospores ovoid to globose, with blunt warts, 5.2~7.2 \times 4.5~5 (~6.5) μm .

Specimen examined: SFC 020405-11

Habitat: on the trunk of *Abies holophylla*

Hydnochaete Bres., Hedwigia 35: 287 (1896) 소나무껍질버섯속 (신칭)

Hydnochaete tabacinoides (Yasuda) Imazeki, Bull. Tokyo Sci. Mus. 6: 103 (1943) 갓소나무껍질버섯 (신칭) (Figs. 1-7, 2-7)

Basidiocarps resupinate to effused-reflexed, narrowly pileate where reflexed; pilei up to 6 mm wide, concentrically zoned, smooth to sulcate, tomentose, dark brown; hymenophore hydroid; teeth up to 1 mm long, 2~3 per mm, rusty brown, crowded.

Hyphal system dimitic; generative hyphae septate without clamps; skeletal hyphae 2.2~3.8 μm wide; setae thin, cylindrical, 32~59 \times 3.4~5.4 μm ; basidia clavate with 4 sterigmata, 13~19 \times 2.5~3.5 μm ; basidiospores hyaline, allantoid to cylindrical, 3.8~5.8 \times 1.2~2 μm .

Specimens examined: SFC 020515-06, 020926-03, 020927-03, 020927-19, 020928-21, 021109-30

Habitat: On fallen branches of *Quercus aliena* and *Prunus serrulata*; on the trunk of *Quercus variabilis*

Family Polyporaceae 구멍장이버섯과

Diplomitoporus Domanski, Acta Soc. Bot. Pol. 39: 191 (1970) 이종구멍버섯속 (신칭)

Diplomitoporus crustulinus (Bres.) Domanski, Acta Soc. Bot. Pol. 39: 192 (1970) 초이종구멍버섯 (신칭) (Figs. 1-8, 2-8)

Basidiocarps resupinate, confluent to form continuous expanses, pale yellowish brown, poroid, up to 5 mm thick; pores circular, 4~5 per mm; tubes up to 4 mm long; context leathery when fresh, woody on drying.

Hyphal system dimitic; generative hyphae with clamps, thin-walled; skeletal hyphae solid, thick-walled, 2~5 μm wide; basidia clavate with 4 sterigmata, 9~13 \times 4~6 μm ; basidiospores allantoid to cylindrical, 5~6.2 \times 2.4~2.8 μm .

Specimen examined: SFC 020418-05

Habitat: on the base of *Quercus aliena*

Fomitopsis cajanderi (Karst.) Kotl. et Pouz. Ceska Mykol. 11: 157 (1957) 살색잔나미버섯 (신칭) (Figs. 1-9, 2-9)

Basidiocarps 1.5~2 cm thick, resupinate, forming a fan-shaped thin bracket, attached tightly; surface slightly convex, smooth, sometimes concentrically furrowed, dark brown; margin usually pinkish when fresh; pores 6~7 per mm, pale to dark pink, pinkish brown in age; tubes 2~3 mm long; context woody hard.

Hyphal system dimitic; generative hyphae septate with clamps, thin-walled, hyaline, 2~4 μm wide; skeletal hyphae thick-walled, 3~4.5 μm wide; basidia clavate with 4 sterigmata, 8~14 \times 3~4 μm ; basidiospores smooth, allantoid, 4.0~4.6 \times 1.0~1.6 μm .

Specimen examined: SFC 020405-17

Habitat: on the branch of *Prunus persica*

Loweporus Wright, Mem. New York Bot. Gard. 28: 225 (1975) 장미구멍버섯속 (신칭)

Loweporus roseoalbus (Jungh.) Ryvarden, in Ryvarden & Johansen, Prelim. Polypore Fl. East Africa 415 (1980) 청장미구멍버섯 (신칭) (Figs. 1-10, 2-10)

Basidiocarps partly resupinate, perennial, closely adnate, thin in the resupinate part, forming a thick false pileus along upper edges; pileal surface narrow, smooth, often faintly sulcate, developing a hard dark crust; margin distinct, entire, obtuse, usually pinkish when fresh; pores 4~5 per mm, pale pink; tubes 1~3 mm long; texture soft woody, becoming hard.

Hyphal system dimitic; skeletal hyphae straight to moderately branched, 3~5 μm wide; basidiospores broadly ellipsoid, 3~4 \times 2~2.5 μm .

Specimen examined: SFC 020927-24

Habitat: on the branch of *Quercus aliena*

Family Stereaceae 꽃구름버섯과

Lopharia cinerascens (Schwein.) G. H. Cunn., Trans. Roy. Soc. New Zealand 83: 622 (1956) 재껍질버섯 (신칭) (Figs. 1-11, 2-11)

Basidiocarps resupinate, confluent to form continuous expanses, sometimes reflexed to semipileate, pale yellowish brown; surface irregularly toothed; teeth 2 mm high, confluent to concentric or polyporoid.

Hyphal system dimitic; generative hyphae without clamps; skeletal hyphae 2.5~3.5 μm wide; cystidia fusiform, rod-shaped, encrusted at the apical part, thick-walled, 80~135 \times 20~22 μm ; basidiospores elliptical to cylindrical, 9.8~13 \times 6.6~7.6 μm , with 1~2 oil drops.

Specimen examined: SFC 020418-18, 021010-24, 021108-41

Habitat: on branches of *Quercus mongolica* and *Quercus aliena*, on the trunk of *Lespedeza formosa*

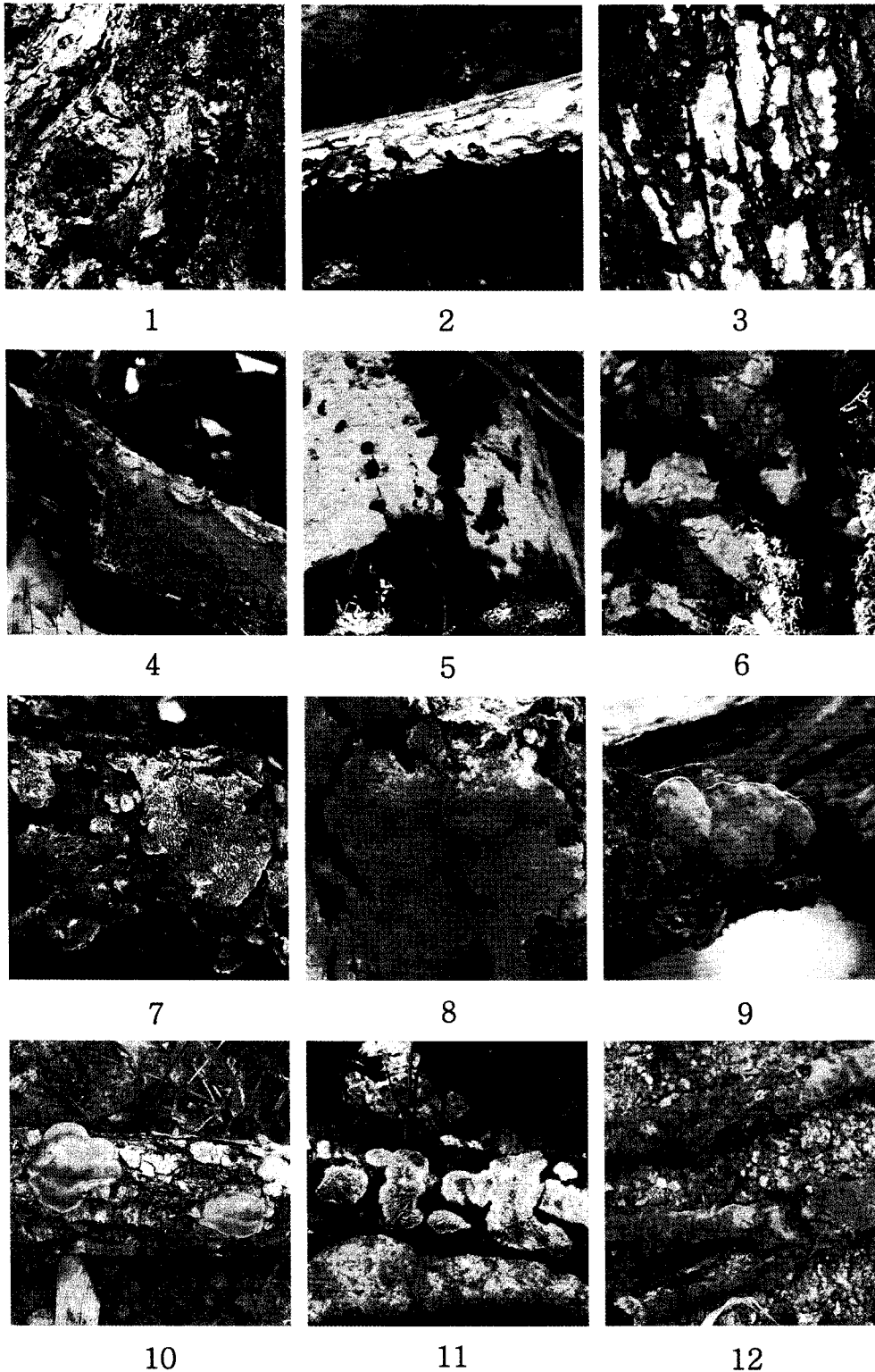


Fig. 1. Fruitbodies of unrecorded species, (1) *Hypoxylon deustum*, (2) *Heterochaete delicata*, (3) *Hyphodontia sambuci*, (4) *Phanerochaete chrysosporium*, (5) *Scytinostroma odoratum*, (6) *Asterostroma cervicolor*, (7) *Hydnochaete tabacinoides*, (8) *Diplomitoporus crustulinus*, (9) *Fomitopsis cajanderi*, (10) *Loweporus roseoalbus*, (11) *Lopharia cinerascens* and (12) *Tomentellina fibrosa*.

Family Thelephoraceae 굴뚝버섯과

Tomentellina Hohn. & Litsch., Sber. Akad. Wiss. Wien, Math.-Naturw. Kl., Abt. 1 115: 1604 (1906) 움모버섯속

(신칭)

Tomentellina fibrosa (Berk. & M.A. Curtis) M.J. Larsen, Mycologia Mem. (St. Paul) 4: 115 (1974) 실움모버섯(신칭)

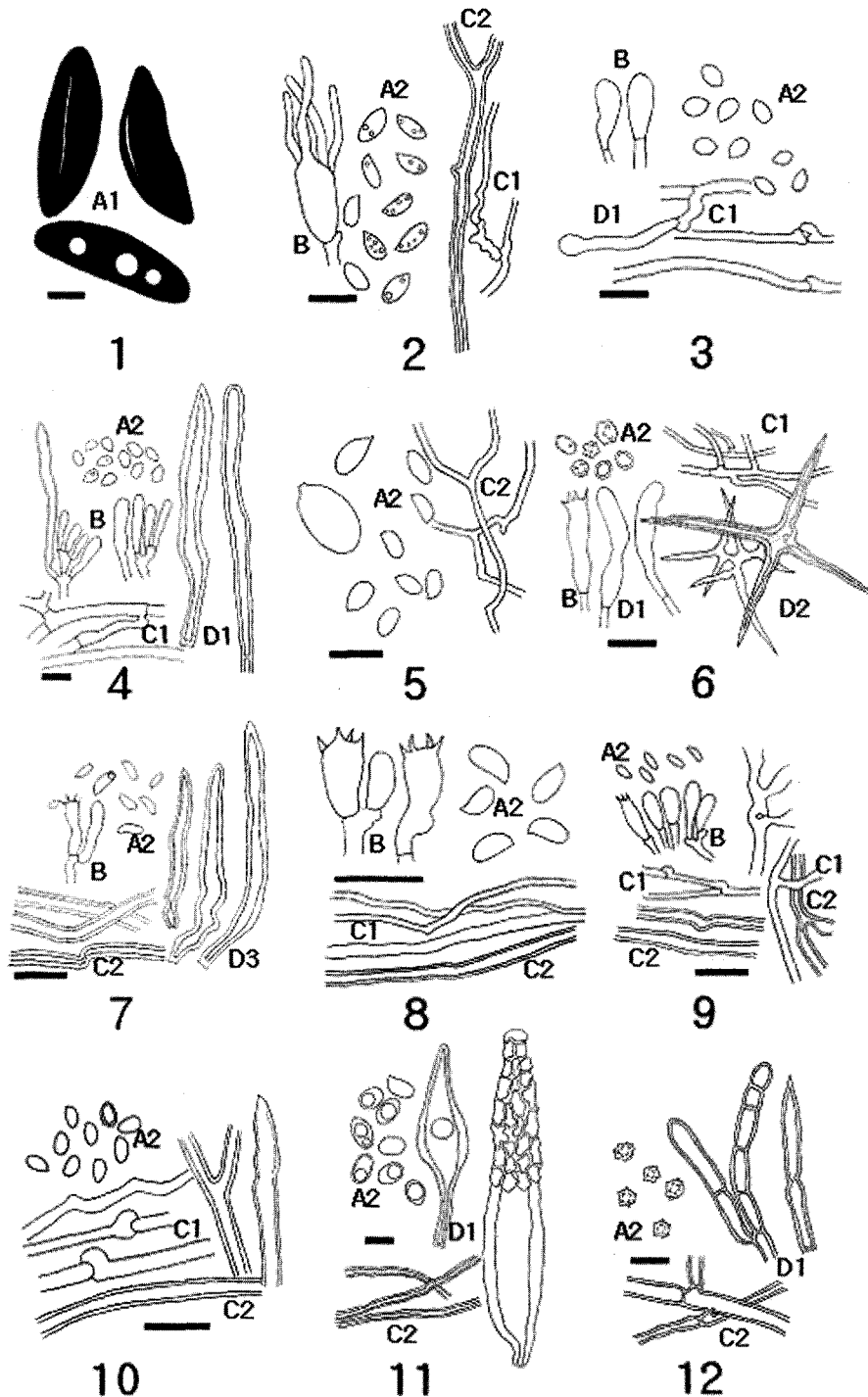


Fig. 2. Microscopic structures of unrecorded species, (1) *Hypoxylon deustum*, (2) *Heterochaete delicata*, (3) *Hyphodontia sambuci*, (4) *Phanerochaete chrysosporium*, (5) *Scytinostroma odoratum*, (6) *Asterostroma cervicolor*, (7) *Hydnochaete tabacinoides*, (8) *Diplomitoporus crustulinus*, (9) *Fomitopsis cajanderi*, (10) *Loweporus roseoalbus*, (11) *Lopharia cinerascens* and (12) *Tomentellina fibrosa*. A1. ascospores; A2. basidiospores; B. young basidia; C1. generative hyphae; C2. skeletal hyphae; D1. cystidia; D2. asterosetae; D3. setae. Bar = 10 μ m.

(Figs. 1-12, 2-12)

Basidiocarps resupinate, forming continuous patches, loosely attached to the substrate, yellowish brown to dark brown; surface smooth or finely tomentose; margin distinct.

Hyphal system dimitic; generative hyphae without

clamps; skeletal hyphae 3.5–7.5 μ m wide; cystidia cylindrical, 120 \times 7.5–9 μ m; basidiospores globose, verrucose, 6.4–7.2 μ m.

Specimen examined: SFC 021109-09

Habitat: on the fallen branch of *Quercus* sp.

Conclusions

From the southern areas of the Songnisan National Park, the fungal flora of higher fungi was regularly searched and identified to the species according to recent classification systems. The checklist amounted to 202 species belonging to 144 genera in 44 families. The fungal diversity of the Songnisan National Park was generally high but showed a tendency of several or some dominant species adapted to the mountain surroundings of mixed forests to show a broad distribution in areas of the mountain. In the lower part (300~600 m in altitude), many fungi were collected from fallen leaves where the shade and moisture are kept well all the time in humus soil of various broad-leaved trees and pine trees. But in the hilly section over 600 m in altitude, almost no fungi were observed because of simple dry environments.

Among the total identified taxa, six genera, *Diplomitoporus*, *Heterochaete*, *Hydnochaete*, *Loweporus*, *Scytinostroma* and *Tomentellina*, and twelve species, *Asterostroma cervicolor*, *Diplomitoporus crustulinus*, *Fomitopsis cajan-deri*, *Heterochaete delicata*, *Hydnochaete tabacinoides*, *Hyphodontia sambuci*, *Hypoxylon deustum*, *Lopharia cinerascens*, *Loweporus roseoalbus*, *Phanerochaete chrysosporium*, *Scytinostroma odoratum* and *Tomentellina fibrosa* were confirmed as new to Korea. It was significant that a number of unrecorded species were newly discovered from this area, suggesting a uniqueness of the fungal flora of the Songnisan National Park.

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