

The Aphylophorales of the Kyeryoungsan National Park

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Through seven field surveys to the Kyeryoungsan National Park from July to December of the year 2001, 116 specimens of the Aphylophorales were collected and taxonomically examined. All the specimens were identified to the species by observation of morphological and microscopic characters, along with old specimens from the Kyeryoungsan National Park of SFC herbarium. They amounted to 10 families, 37 genera and 52 species, and two species among them, *Antrodia xantha* and *Ceriporia viridans*, were confirmed as new to Korea and are described here as unrecorded species.

KEYWORDS: Aphylophorales, Kyeryoungsan, Unrecorded species

Kyeryoungsan is located in the Kyeryoungsan National Park area to the west of Daejeon Metropolitan City in Chungcheongnam-do, providing green nature and pleasant places to city people. The main peak of the mountain rises 845 m high in altitude, temperature averages around 11°C throughout the year, and precipitation amounts to 1,280 mm a year most of which is poured during June to September (Doosan Corporation, 2000). The area is generally rocky in formation with a variety of gradients from gentle to steep slopes and the land tends to be well drained and dried except for the rainy season.

Until recently, there has been no floral study on the fungi of the Aphylophorales in this mountain and the information on their occurrence has been needed. For the search of the fungal distribution in this mountain, regular field surveys were made to this area and fresh basidiocarps were collected from five different selected parts of the national park (Fig. 1) through seven field surveys from July to December in 2001. As the surface of the mountain remains usually dry soon after the drain of rain, the fungi of the Aphylophorales adapted to such environments of mixed forests were growing as common taxa.

The habitats of fungi were observed and the host trees on which they grow recorded. Total 116 specimens of the Aphylophorales (Hymenomycetes, Basidiomycota) were collected and identified to the species to see the aphylophoroid diversity of the Kyeryoungsan National Park. They consisted of common wood-rotting fungi and most of them formed a cosmopolitan group growing on dead tree materials. Voucher specimens have been deposited in SFC (Seoul National University Fungus Collection) after the examination.

Through taxonomic studies on collected samples, fungal taxa belonging to the Aphylophorales were enumerated and classified according to recent systematic schemes.

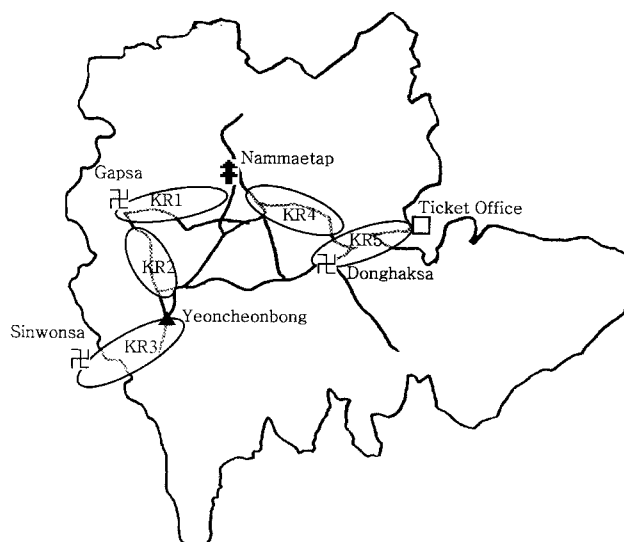


Fig. 1. Research area of the Kyeryoungsan National Park. KR1, between Gapsa and Nammaetap; KR2, between Gapsa and Yeoncheonbong; KR3, between Sinwonsa and Yeoncheonbong; KR4, between the ticket office and Nammaetap; KR5, between the ticket office and Donghaksa. Inside bold line = hiking trail.

They represented 52 species of 37 genera in 10 families of the Aphylophorales. Among them, taxa of the Polyporaceae were most abundant in occurrence and then those of the Corticiaceae were second common in distribution.

About ten species like *Hyphoderma setigerum*, *Antrodia heteromorpha*, *Fomitella fraxinea*, *Fomitopsis rosea*, *Irpex lacteus*, *Microporus vernicipes*, *Schizopora paradoxa*, *Trametes versicolor*, *Trichaptum abietinum*, and *Stereum peculiare* seemed to be well-adapted to dried mixed forests and were growing as dominant species. A number of hardwood trees were common hosts throughout the mountain area. *Quercus* species were most predominant hardwood hosts and *Pinus densiflora* was the only unique

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conifer host in forests. During the floral study, two species of the Polyporaceae, *Antrodia xantha* and *Ceriporia viridans*, were confirmed as new to Korea and are described here with descriptions and new Korean names.

There seem to be no comparable data on fungal floras of aphyllorphoroid taxa from inland mountains, but the fungal flora of the island area like Ullung-do (Jung, 1992) can be compared with present results. In Ullung-do, there were three common or frequent species, *Trametes hirsutus*, *T. versicolor*, and *Irpex lacteus*, which played an important role as dominant species in the forest ecology of Ullung-do. In the Kyeryoungsan National Park, trees of *Quercus* were most important hosts, but in the island environments of Ullung-do, most fungi grew on hardwood trees like *Fagus crenata* var. *multinervis*, *Alnus*, and *Sorbus*. Both in the park and in the island, *Pinus* was always the best host among conifer trees.

Compared with the fungal flora of island environments, the fungal diversity of the Kyeryoungsan 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 and a few restricted unrecorded species to demonstrate a unique local distribution of aphyllorphoroid fungi.

Taxonomy

For the observation of specimens, laboratory techniques by Largent *et al.* (1977) and microscopic methods by Jung (1987) were applied. Most of fungi collected and classified here belong to two families, the Polyporaceae and the Corticiaceae, of the Aphyllophorales. For the general taxonomy of the Aphyllophorales, Donkian concept (Donk, 1964) was adopted. 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. Studies of Gilbertson and Ryvarden (1986, 1987) and Ryvarden and Gilbertson (1993, 1994) were referred for polypores and the study of Lim and Jung (1999) was consulted for *Stereum*. Illustrations of Breitenbach and Kränzlin (1986), Imazeki and Hongo (1965, 1989) and Imazeki *et al.* (1988) were frequently looked up for general fungi. For the search of the fungal flora on Korean Aphyllophorales, Jung (1994, 1995, 1996a, 1996b), Lim *et al.* (1999) and Lim and Jung (2000, 2001) 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 aphyllorphoroid fungi were always taken into consideration in identification of species.

Family Cantharellaceae

1. *Cantharellus cibarius* Fr.
Localities: KR3
Substrate: on humus of conifer litter
Specimens: SFC 010809-04

Family Coniophoraceae

2. *Pseudomerulius aureus* (Fr.) Jül.
Localities: KR2
Substrate: a fallen branch of a hardwood tree
Specimens: SFC 010807-17

Family Corticiaceae

3. *Botryobasidium obtusisporum* J. Erikss.
Localities: KR4
Substrate: *Pinus densiflora*
Specimens: SFC 010724-13
4. *Cylindrobasidium evolvens* (Fr.) Jül.
Localities: KR5
Substrate: *Zelkova serrata*
Specimens: SFC 010710-04
5. *Hyphoderma setigerum* (Fr.) Donk
Localities: KR2, KR3, KR4, KR5
Substrate: *Styrax japonicum*, *Acer palmatum*, *Pinus densiflora*
Specimens: SFC 010724-03, SFC 010726-20, SFC 010807-05, SFC 010807-18, SFC 010809-15, SFC 011222-02
6. *Mycoacia fuscoatra* (Fr.) Donk
Localities: KR4
Substrate: *Zelkova serrata*
Specimens: SFC 950211-34
7. *Phanerochaete crassa* (Lév.) Burdsall
Localities: KR1
Substrate: *Quercus dentata*
Specimens: SFC 010705-14
8. *Phanerochaete filamentosa* (Berk. et Curt.) Burdsall
Localities: KR3, KR4
Substrate: *Pinus densiflora*
Specimens: SFC 010724-05, SFC 010809-13
9. *Phanerochaete sordida* (Karst.) J. Erikss. et Ryv.
Localities: KR4, KR5
Substrate: *Quercus* spp.
Specimens: SFC 010710-09, SFC 010710-23, SFC

010724-14

10. *Phlebia chrysocrea* (Berk. et Curt.) Burdsall
Localities: KR2, KR3, KR4
Substrate: *Quercus* sp., *Styrax japonicum*, *Alnus japonica*
Specimens: SFC 950211-26, SFC 010807-02, SFC 010809-25

11. *Phlebiopsis gigantea* (Fr.) Jül.
Localities: KR3
Substrate: *Crataegus pinnatifida*
Specimens: SFC 010809-21

Family Ganodermataceae

12. *Ganoderma applanatum* (Pers.) Pat.
Localities: KR5
Substrate: *Acer pictum* var. *mono*
Specimens: SFC 011222-07

Family Hydnaceae

13. *Lopharia mirabilis* (Berk. et Br.) Pat.
Localities: KR4
Substrate: an unknown dead tree
Specimens: SFC 010726-11
14. *Steccherinum laeticolor* (Berk. et Curt.) Banker
Localities: KR1, KR4
Substrate: *Quercus* sp., *Alnus japonica*
Specimens: SFC 010705-09, SFC 010726-17, SFC 010726-23
15. *Steccherinum ochraceum* (Pers.) S. F. Gray
Localities: KR4
Substrate: *Quercus variabilis*
Specimens: SFC 010724-08

16. *Steccherinum rhois* (Schw.) Banker
Localities: KR4
Substrate: a hardwood tree
Specimens: SFC 011222-03

Family Hymenochaetaceae

17. *Hymenochaete cinnamomea* (Pers.) Quél.
Localities: KR3
Substrate: *Pinus densiflora*
Specimens: SFC 010809-17
18. *Hymenochaete yasudai* Imaz.
Localities: KR2, KR5
Substrate: *Pinus densiflora*
Specimens: SFC 010807-28, SFC 011222-18

19. *Inonotus mikadoi* (Lloyd) Imaz.
Localities: KR4, KR5
Substrate: *Quercus* spp.
Specimens: SFC 010726-14, SFC 011222-15

20. *Inonotus xeranticus* (Berk.) Imaz. et Aoshi.
Localities: KR5
Substrate: *Quercus* sp.
Specimens: SFC 011222-13

21. *Phellinus baumii* Pilát
Localities: KR2
Substrate: *Quercus variabilis*
Specimens: SFC 010807-31

Family Meruliaceae

22. *Merulius tremellosus* Fr.
Localities: KR2
Substrate: *Quercus* sp.
Specimens: SFC 010807-15

Family Polyporaceae

23. *Antrodia heteromorpha* (Fr.) Donk
Localities: KR1, KR2, KR4, KR5
Substrate: *Quercus* spp., *Castanea crenata*
Specimens: SFC 950211-02, SFC 950211-22, SFC 010705-18, SFC 010807-09
24. *Antrodia malicola* (Berk. & Curt.) Donk
Localities: KR4
Substrate: *Pinus densiflora*
Specimens: SFC 010726-13
25. *Antrodia xantha* (Fr.) Ryv., Norw. J. Bot. 20:8, 1973
유황주름구멍버섯 (신칭)
Basidiocarps annual, resupinate, widely effused, often slightly reflexed as narrow pilei on vertical surface, adnate, up to 4 mm thick, soft when fresh, chalky when dry, lemon yellow to cream when fresh, fading to almost white on drying, cracking into squares when old; pores round, 6~9 per mm; tubes cream to white; margin narrow, white; context thin and white.
Hyphal system dimitic; generative hyphae clamped, thin-walled, 2~4 μ m wide; skeletal hyphae abundant, thick-walled to semisolid, 3~5 μ m wide; cystidia none; basidia clavate, 15~20 \times 7~10 μ m; basidiospores allantoid, hyaline, 5~6 \times 1~1.5 μ m.
Localities: KR2
Substrate: *Quercus* sp.
Specimens: SFC 010807-21
Remarks: This polypore is known to be circumboreal in distribution and commonly grows on conifers but also

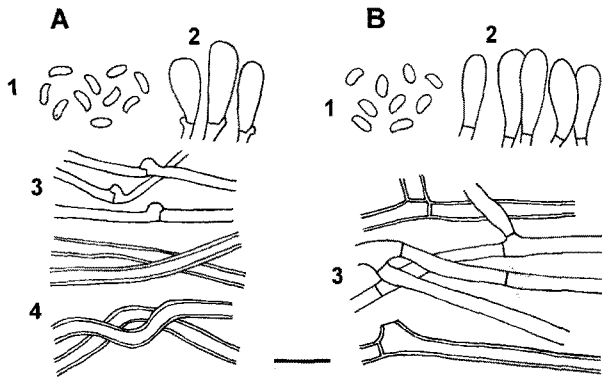


Fig. 2. Microscopic structures of unrecorded species, *Antrodia xantha* (A) and *Ceriporia viridans* (B). 1. basidiospores; 2. young basidia; 3. generative hyphae; 4. skeletal hyphae. bar = 10 μ m.

rarely on hardwoods (Gilbertson and Ryvardeen, 1986; Ryvardeen and Gilbertson, 1993). In fields, its pale bright yellow color and cracking surface become good indicators for the species.

26. *Bjerkandera adusta* (Willd.: Fr.) Karst.

Localities: KR5
Substrate: *Styrax japonicum*
Specimens: SFC 010710-25

27. *Bjerkandera fumosa* (Fr.) Karst.

Localities: KR5
Substrate: *Quercus* sp.
Specimens: SFC 950211-03

28. *Ceriporia viridans* (Berk. & Br.) Donk, Med. Bot. Mus. Univ. Utrecht 9:171, 1993 그물구멍버섯 (신칭)

Basidiocarps annual, resupinate, effused, adnate, up to 3 mm thick, soft when fresh, rather fragile when dry, cream to sordid pinkish-brown, variable in color; pores round to sinuous, often variable in shape and size, 3~5 per mm; margin narrow, white.

Hyphal system monomitic; generative hyphae simple-septate, frequently branched, often at right angles, somewhat thick-walled in the subiculum, 2.5~5 μ m wide in the trama; cystidia none; basidia clavate, 11~15 \times 4.5~6 μ m; basidiospores cylindrical to allantoid, hyaline, 4~5 \times 1.5~2 μ m.

Localities: KR1
Substrate: *Pinus densiflora*
Specimens: SFC 010705-13

Remarks: This fungus is reported as a variable species in color and pores and a number of species have been described on its variable characters (Gilbertson and Ryvardeen, 1986; Ryvardeen and Gilbertson, 1993). It usually occurs on many genera of hardwoods but the SFC specimen was collected from a pine of rotten wood.

29. *Cerrena consors* (Berk.) Ko et Jung (1999)

Localities: KR3, KR4
Substrate: dead hardwood tree, *Pinus densiflora*
Specimens: SFC 010726-04, SFC 010809-05

30. *Cerrena unicolor* (Fr.) Murr.

Localities: KR5
Substrate: *Quercus serrata*
Specimens: SFC 950211-13

31. *Cryptoporus volvatus* (Peck) Shear

Localities: KR2, KR4
Substrate: *Pinus densiflora*
Specimens: SFC 010726-16, SFC 010807-04, SFC 010807-25

32. *Daedalea dickinsii* (Berk.: Cooke) Yasuda

Localities: KR2
Substrate: *Quercus* sp., *Acer palmatum*
Specimens: SFC 010807-12, SFC 010807-24

33. *Daedaleopsis styracina* (P. Henn. et Shirai) Imaz.

Localities: KR2, KR3, KR4, KR5
Substrate: *Styrax japonicum*
Specimens: SFC 010710-24, SFC 010724-07, SFC 010807-20, SFC 010809-08

34. *Datronia mollis* (Sommerf.: Fr.) Donk

Localities: KR4, KR5
Substrate: *Quercus* spp.
Specimens: SFC 950211-17, SFC 010726-21

35. *Fomitella fraxinea* (Fr.) Imaz.

Localities: KR1, KR3, KR4, KR5
Substrate: *Robinia pseudoacacia*, *Cornus walteri*
Specimens: SFC 010705-03, SFC 010710-01, SFC 010724-01, SFC 010726-06, SFC 010809-01

36. *Fomitopsis rosea* (A. et S.: Fr.) Karst.

Localities: KR1, KR2, KR4, KR5
Substrate: *Quercus acutissima*, *Quercus aliena*, *Zelkova serrata*
Specimens: SFC 950211-27, SFC 010705-07, SFC 010710-11, SFC 010807-16, SFC 010807-19, SFC 010807-27, SFC 010807-29, SFC 010807-30

37. *Irpex lacteus* Fr.

Localities: KR2, KR3, KR5
Substrate: *Quercus* sp., *Robinia pseudoacacia*, *Zelkova serrata*, *Pinus densiflora*
Specimens: SFC 950211-10, SFC 010710-20, SFC 010807-13, SFC 010809-14

38. *Microporus vernicipes* (Berk.) Kuntze

- Localities: KR1, KR2, KR3, KR4, KR5
 Substrate: *Quercus serrata*, *Prunus serrulata*, *Carpinus laxiflora* var. *laxiflora*, *Alnus japonica*, *Pinus densiflora*
 Specimens: SFC 950211-30, SFC 010705-08, SFC 010710-08, SFC 010726-09, SFC 010726-15, SFC 010807-01, SFC 010809-06
39. *Polyporus varius* Pers.: Fr.
 Localities: KR5
 Substrate: on soil
 Specimens: SFC 010710-12
40. *Pycnoporus cinnabarinus* (Fr.) Karst.
 Localities: KR1
 Substrate: a fallen branch of *Quercus* sp.
 Specimens: SFC 010705-23
41. *Pycnoporus coccineus* (Fr.) Bond. et Sing.
 Localities: KR4
 Substrate: a fallen branch of a hardwood tree
 Specimens: SFC 010726-02
42. *Rigidoporus microporus* (Fr.) Overeem.
 Localities: KR1
 Substrate: *Alnus japonica*
 Specimens: SFC 010705-11
43. *Schizopora flavipora* (Cooke) Ryv.
 Localities: KR5
 Substrate: *Castanea crenata*
 Specimens: SFC 010710-14
44. *Schizopora paradoxa* (Fr.) Donk
 Localities: KR2, KR3, KR5
 Substrate: *Quercus* sp., *Prunus serrulata*, *Acer palmatum*, *Styrax japonicum*, *Pinus densiflora*
 Specimens: SFC 010710-02, SFC 010807-14, SFC 010807-26, SFC 010809-12, SFC 010809-22
45. *Trametes versicolor* (L.: Fr.) Pilát
 Localities: KR3, KR4, KR5
 Substrate: *Quercus serrata*, *Prunus serrulata*, *Weigela hortensis*
 Specimens: SFC 950211-15, SFC 010710-17, SFC 010724-15, SFC 010726-19, SFC 010809-07
46. *Trichaptum abietinum* (Fr.) Ryv.
 Localities: KR2, KR3, KR4, KR5
 Substrate: *Pinus densiflora*
 Specimens: SFC 950211-28, SFC 010807-03, SFC 010809-18, SFC 011222-17
47. *Trichaptum bifforme* (Fr.) Ryv.
 Localities: KR2, KR3, KR5

Substrate: *Quercus aliena*, *Acer pictum* var. *mono*
 Specimens: SFC 010807-23, SFC 010809-16, SFC 011222-09

48. *Tyromyces sambuceus* (Lloyd) Imaz.
 Localities: KR2
 Substrate: *Quercus serrata*
 Specimens: SFC 010807-11

Family Schizophyllaceae

49. *Schizophyllum commune* Fr.: Fr.
 Localities: KR3
 Substrate: *Zelkova serrata*
 Specimens: SFC 950211-40

Family Stereaceae

50. *Stereum gausapatum* Fr.: Fr.
 Localities: KR2
 Substrate: *Quercus* sp.
 Specimens: SFC 010807-10
51. *Stereum peculiare* Boidin, Parmasto et Dhingra
 Localities: KR1, KR2, KR3, KR4, KR5
 Substrate: *Quercus* spp., *Prunus serrulata*
 Specimens: SFC 010705-10, SFC 010710-21, SFC 010724-09, SFC 010807-08, SFC 010809-02
52. *Stereum subtomentosum* Pouzar
 Localities: KR4, KR5
 Substrate: *Quercus serrata*
 Specimens: SFC 950211-38, SFC 010710-18, SFC 011222-11

Conclusions

The higher fungal flora of Kyeryongsan was investigated from July to December in 2001. Total 116 collections belonging to the Aphyllophorales (Hymenomycetes, Basidiomycota) were identified to the species according to recent classification systems. The checklist amounted to 52 species belonging to ten families Cantharellaceae, Coniophoraceae, Corticiaceae, Ganodermataceae, Hydnaceae, Hymenochaetaceae, Meruliaceae, Polyporaceae, Schizophyllaceae and Stereaceae of the Aphyllophorales. Among them, *Hyphoderma setigerum* of the Corticiaceae, eight common wood-rotting polypores of the Polyporaceae and *Stereum peculiare* of the Stereaceae were growing as dominant species. Among host trees, *Quercus* species was most common hosts and *Pinus densiflora* was the only conifer host. As a result of this floral study, *Antrodia xantha* and *Ceriporia viridans* of the Polyporaceae were confirmed as new taxa to Korea. Compared with the taxa of

island environments, those of the Kyeryoungsan National Park were higher in fungal diversity and showed a tendency of dominant species adapted to mountain surroundings and a few limited unrecorded species to demonstrate a unique local distribution of aphyllorphoid fungi.

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