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Occurrence and Distribution of Cellular Slime Molds by Vegetation in Mt. Seorak

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설악산에서의 식생에 따른 세포성 점균의 출현과 분포

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ABSTRACT

This study was carried out to investigate occurrence and distribution of cellular slime molds by vegetation in Mt. Seorak. Eleven species were isolated from surface soil samples as follows: *P. violaceum, P. candidum, P. purpureum, D. brefeldianum, D. minutum, D. delicatum, D. crassicaule, D. macrocephalum, D. firmibasis, D. polycephalum* and *D. implicatum.* The dorminant species was *D. brefeldianum. D. delicatum, D. implicatum, D. polycephalum* and *P. candidum* of them were isolated rarely in Korea. It can be thought that these results were caused by characteristics of forest zone and geographical condition which Mt. Seorak is located at east side of central areas of Korea.

Key words: Occurrence, Distribution, Cellular slime molds, Vegetation, Mt. Seorak, *Dictystelium brefeldianum, Polysphondylium candidum.*

INTRODUCTION

More dictyostelid cellular slime molds than sixty species found in the world were isolated from the fermentation and humus layers of surface soils of forests and grass, and the dung of animals (Hagiwara 1989, Raper 1984, Hong and Chang 1990, Park and Chang 1996, Shim and Chang 1996, Shim 1998). Dictyostelids occurred were isolated from soils of tundra, desert, cave, coastal area, riversides, streamsides, lake littoral zones and alpine zones (Benson and Mahoney 1977, Landolt 1992, Cavender 1980, Hagiwara 1990, 1992, 1993, Hong *et al.* 1992, Kwon and Chang 1996, Stephenson *et a* 1997, Shim and Chang 1997).

It was known that the distribution and occurrence of them correlated with ecological and geographical characteristics. It was investigated that dictyostelids distributed and occurred with aspects of vegetation and geographical conditions (Hagiwara 1989, Chang et al. 1996a, b, Hong *et al.* 1992, Landolt and Stephenson 1990). The distribution of cellualr slime molds was due to the soil qualities. Stephenson (1988), Eisenberg *et al.* (1989) and Ketachm *et al.* (1988) reported that dictyostelids were affected by moisture, soil acidity and prey bacteria. Chang *et al.* (1996a, b), Eisenberg *et al.* (1989), Hagiwara *et al.* (1992), Hong and Chang (1990, 1991), Ketachm *et al.* (1988), Shim and Chang (1996, 1997) suggested the

relevance of cellualr slime molds to inter-and intra-species comopetitive interactions, temperature, vegetations and altitudes. Hong and Chang (1996) reported that soil condition such as pH and amounts of moisture and organics affected species diversity because of prey bacteria and other microorganisms in soil. Shim and Chang (1996) suggested that cellular slime molds be more affected by forest types than altitudes and climates. Shim and Chang (1998) reported one new dictyostelid cellualr slime mold, *D. caudabasis,* Shim et Chang isolated from *Quercus mongolica* forest soils of Hangyeryong in Mt. Seorak, Kangwondo, South Korea.

The present paper was investigted to the occurrence and distribtuion of dictyostelid sellular slime molds by vegetation and altitudes in Mt. Seorak, Kangwondo, South Korea. Mt. Seorak is located at the eastwest of central areas of South Korea.

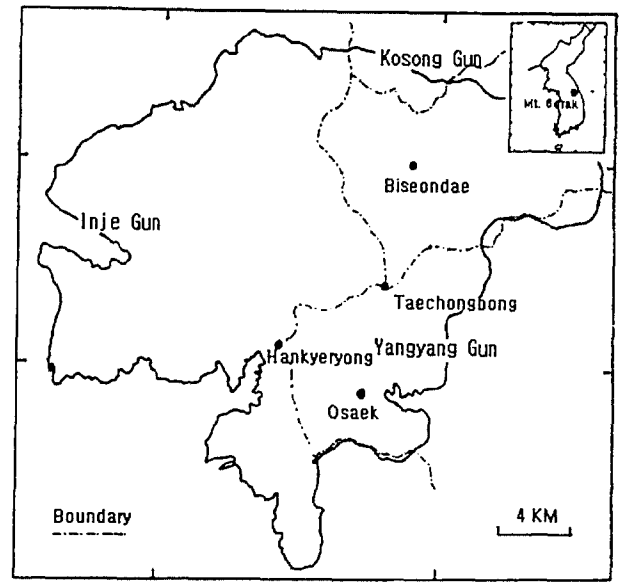

Fig. 1. Sampling sites in Mt. Seorak, Kangwondo, Korea.

MATERIALS AND METHODS

Dictyostelids were isolated from collecting soil samples from decaying litters of humus and fermentation layers of surface soils in Mt. Seorak, Kangwondo, South Korea. Isolation of dictyostelids was performed according to clonal isolation techniqe. Innoculation of dictyostelids was at the center of cross stre-

Table 1. Properties of soil samples in Mt. Seorak

Site	Sa 1	Sa 2	Sa 3	Sa 4	Sa 5	Sa 6	Sa 7	Sa 8
Altitude (m)	480	530	580	700	750	900	980	1010
Forest type	*Quercus mongolica*	*Quercus mongolica*	*Pinus densiflora*	*Quercus mongolica*	*Quercus mongolica*	*Pittosporum tobira*	*Abies nephrolepis*	*Abies nephrolepis*
Water content(%)	43.07	78.07	38.12	50.65	48.34	75.11	32.20	49.10
Organic matter(%)	32.93	19.09	39.65	32.10	36.50	21.59	50.28	35.20
pH	5.77	5.54	5.78	5.60	5.64	6.46	6.68	5.57

Site	Sa 9	Sa 10	Sa 11	Sa 12	Sa 13	Sa 14	Sa 15	Sa 16
Altitude (m)	1170	1410	1600	1500	1000	600	650	670
Forest type	*Pinus koraiensis*	*Quercus mongolica*	*Pinus pumila*	*Quercus mongolica*	*Quercus mongolica*	*Fraxinus mandshurica*	*Quercus mongolica*	*Quercus mongolica*
Water content(%)	29.10	44.09	26.75	44.20	60.29	65.90	44.11	49.75
Organic matter(%)	31.00	20.79	53.85	48.08	31.43	30.06	34.50	34.42
pH	5.41	5.63	4.85	5.34	5.94	6.91	5.50	5.99

aks made with a suspension of $10^8 \sim 10^{10}$ No./ml bacteria and incubated at 20~25℃. They were observed characteristics such as aggregation patterns, color of sorophore and sori, tips and bases of sorophore, spore size, polar granule present or absent and sorophore formation. Identification and classification of them were based on the dichotomy systems of Raper (1984), Hagiwara (1989), Hong and Chang (1992) and Shim (1998). Data for each species at each site were represented as not only sample frequency and density but relative density, site frequency, average frequency and importance value. Altitudes, vegetation, amounts of soil moisture and organics, and soil pH are shown in Table 1.

RESULTS AND DISCUSSION

Elven dictyostelids were isolated from soils of 16 sampling sites in Mt. Seorak as follow; genus Polysphondylium 2 species, *P. violaceum* and *P. candidum*,

Table 2. Occurrence of cellular slime molds in Mt. Seorak

Species	Sa 1		Sa 2		Sa 3		Sa 4		Sa 5		Sa 6		Sa 7		Sa 8		Sa 9	
	F[1]	D[2]	F	D	F	D	F	D	F	D	F	D	F	D	F	D	F	D
D. brefeldianum	–	–	–	–	–	–	67	24	50	44	100	69	67	86	50	57	100	94
D. minutum	–	–	–	–	–	–	–	–	33	55	100	31	67	14	17	36	–	–
P. violaceum	33	36	–	–	33	31	–	–	17	1	–	–	–	–	17	1	–	–
D. delicatum	33	4	–	–	33	69	–	–	–	–	–	–	–	–	17	6	–	–
D. firmibasis	33	61	–	–	–	–	–	–	17	1	–	–	–	–	–	–	33	6
P. candidum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. polycephalum	–	–	–	–	–	–	67	76	–	–	–	–	–	–	–	–	–	–
D. implicatum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17	1	–	–
D. purpureum	–	–	33	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. crassicuale	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. macrocephalum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total clones (No/g)	467		233		1,800		6,550		17,775		181,800		87,183		10,791		12,400	

Species	Sa 10		Sa 11		Sa 12		Sa 13		Sa 14		Sa 15		Sa 16		RD	AF	SF	IV
	F	D	F	D	F	D	F	D	F	D	F	D	F	D				
D. brefeldianum	100	100	–	–	100	100	100	100	33	54	–	–	–	–	81	48	63	91
D. minutum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17	17	25	26
P. violaceum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<1	8	25	11
D. delicatum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<1	6	19	8
D. firmibasis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<1	6	19	8
P. candidum	–	–	33	100	–	–	–	–	100	46	–	–	–	–	<1	8	13	7
D. polycephalum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	6	4
D. implicatum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<1	2	6	3
D. purpureum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	<1	2	6	3
D. crassicuale	–	–	–	–	–	–	–	–	–	–	100	100	–	–	<1	2	6	3
D. macrocephalum	–	–	–	–	–	–	–	–	–	–	–	–	100	100	<1	2	6	3
Total clones (No/g)	209,267		483		3,200		122,683		433		401		389					

[1] F(Sample Frequency, %) = (the number of samples that a species occurred / the number of samples in a site) × 100
D(Density, %) = (the number of clones of a species / total number of clones of all species) × 100

[2] RD(Relative density, %) = (the number of clones of a species / total number of clones) × 100
SP(Site Frequency, %) = (the number of sites that a speices occurred / total number of sites) × 100
RF(Relative Frequency, %) = (the number of samples that a species occurred / total number of sites) × 100
IV(Importance Value) = (2RD+SP+AF) / 3

and genus *Dictyostelium* 9 species, *D. brefeldianum*, *D. minutum*, *D. delicatum*, *D. firmibasis*, *D. polycephalum*, *D. implicatum*, *D. purpureum*, *D. crassicaule* and *D. macrocephalum* (Table 2). The average number of species at one site was 1.93 and average density was 40,991 No. of clones/g soil. *D. brefeldianum* of them was dominant in Mt. Seorak. The number of clones of this species was more than 62% of total clones. Particulary, *D. delicatum*, *D. implicatum*, *D. polycephalum* and *P. candidum* that were scarecely found in Koera, were isolated in Mt. Seorak. While *D. mucoroides* and *P. pallidum* that had higher frequency, were not found. It can be thought that these results were caused by characteristics of forest zone and geographical condition, for Mt. Seorak is located at east side of central areas of Korea. Rare species, *P. candidum*, was isolated in Mt. Taebaek as well as Mt. Seorak (Park and Chang 1996). It is thought that this species was found in the forests of central area.

In the result of comparison broadleaved forests with conifer forests of occurrence and distribution of cellualr slime molds in Mt. Seorak, the average mumber of species and importance value for each species were consistent. Also, the composition of species was almost similar but there was a little difference in species of which importance values were low. It was the result of the difference in species distribution by the amounts of water contents and organic material contents.

D. delicatum that Shim and Chang (1996) reported in Mt. Chiri, was isolated from surface litter layers of *Quercus mongolica*, *Pinus densiflora* and *Abies nephrolepis* in Mt. Seorak. This was rare species, while in Japan, comparatively frequent one (Cavender and Kawabe, 1989). *D. firmibasis* found in the subalpine and alpine forests of Mt. Kyerong, Mt. Taebaek, Mt. Sobaek, Mt. Dukyu and mountains in Japan (Park and Chang 1996, Hagiwara 1989). However, in this investigation, it was present from low altitude area. It was found that numbers of clones correlated with the amounts of water contents. More clones were isolsted from soil samples including 30~45% water content Optimal acidity was pH 5.6~6.9 in this area.

적 요

설악산의 삼림 식생에 따른 딕티오형 세포성 점균의 출현과 분포를 조사하였다. 이 지역에서 11종이 분리되었는데, *P. violaceum* (자주돌려난가지팡이), *P. candidum* (좀돌려난가지팡이), *P. purpureum* (자주구슬팡이), *D. brefeldianum* (가는구슬팡이), *D. minutum* (좀구슬팡이), *D. delicatum* (여린구슬팡이), *D. crassicaule* (좀고사리팡이), *D. macrocephalum* (큰머리팡이), *D. firmibasis* (장대팡이), *D. polycephalum* (포도송이구슬팡이)과 *D. implicatum* (침구슬팡이)이다. 최우점종은 *D. brefeldianum*이며, 우리 나라에서는 분포지역이 적은 *D. delicatum*, *D. implicatum*, *D. polycephalum* and *P. candidum*이 출현하였다. 우리 나라 중부 지역의 동쪽에 위치하고 있는 설악산의 삼림 특성과 지리적 특성에 기인한 것으로 사료된다.

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