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Occurrence and Distribution of Cellular Slime Molds by Vegetation in Island Ulneungdo

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울릉도에서의 세포성 점균의 출현과 분포

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ABSTRACT

Thirteen dictyostelid cellular slime molds were isolated from forest soils, cattle dung and manure in island Ulneungdo, South Korea. They were ten species including *Dictyostelium aureo-stipes* var. *aureo-stipes*, *D. brefeldianum*, *D. macrocephalum*, *D. caudabasis*, *D. sphaerocephalum*, *D. giganteum*, *D. crassicaule*, *Polysphondylium pallidum*, *P. violaceum* and *P. tenuissimum* as well as three species unidentified. *D. aureo-stipes* var. *aureo-stipes* was dominant species that much higher importance value than others. In particularly, all three species of genus *Polysphondylium* distributed widely. It was thought that species diversity was considerabley higher.

Key words: Occurrence, Distribution, Cellualr slime molds, Ulneungdo, *Dictyostelium aureo-stipes* var. *aureo-stipes*.

INTRODUCTION

Dictyostelid cellular slime molds were distributed worldwidely including temperated, alpine and sub alpine zone, tundra, desert, cave, coastal area, riversides, streamsides, and lake littoral zones (Benson and Mahoney 1977, Landolt and Stephenson 1990, Cavender 1980, Hagiwara 1989, 1990, 1992a, 1993, Hong *et al.* 1992, Kwon and Chang 1996, Raper 1984, Stephenson *et al.* 1997, Shim and Chang 1997). They were isolated from the decomposing layers of surface soills of mountain forests and grass and cultivated field, and the dung of animals (Hagiwara 1989, 1993, Raper 1984, Hong and Chang 1990, Shim and Chang 1996a, Shim 1998).

Eisenberg *et al.* (1989) suggested that dictyostelids were affected by ecological and physiological factors. Hagiwara (1992a) investigated on relationship between the flora of cellular slime molds and vegetation by altitudes in Mt. Nanga Parbat, Pakistan.

The distribution of cellualr slime molds was due to not only biotic factors such as vegetation, prey bacteria and competitive interaction, but geological physical factors as soil acidity, moisture content, amounts of organics, altitude, temperature and climates (Stephenson 1988, Eisenberg *et al.* 1989, Ketachm *et al.* 1988, Hong *et al.* 1992, Shim and Chang 1996a, 1996b, 1997).

This paper was investigated to the occurrence and distribtuion of dictyostelid sellular slime molds by vegetation and altitudes in island Ulneungdo, Kyungsangbukdo, South Korea.

MATERIALS AND METHODS

Ulneungdo is an island that is located in 130° 47' 40″~130° 55′ E and 37° 29′ 31″~37° 33′ 31″ N, and 140km from Uljin, Kangwondo and 268km from Pohang, Kyungsngbukdo to the sea. Main island is rough 12km from east to west and rough 10km from south to north, and area of that is 75.4km². Annual mean temperature and precipitation are 12℃ and 1, 473.4mm repectively.

To isolate dictyostelid cellualr slime molds, soil samples collected from decaying zones of surface soils in island Ulneungdo, Kyungsangbukdo, South Korea. Isolation of dictyostelids was performed according to clonal isolation techniqe. Innoculation of dictyostelids was at the center of hay confusion plates that were spreaded with a suspension of bacteria (*Escherichia coli* 10^8~10^{10} No./ml), and plates were incubated at 20~25℃. After identifing, to classify, they were inoculated on 0.1% LP media plates cross-streaked with bacteria suspension, and 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). Clones, frequency and density were calculated from sample soils, and relative density, site frequency, average frequency and importance value were determined. Altitude, vegetation, amounts of soil moisture and or-

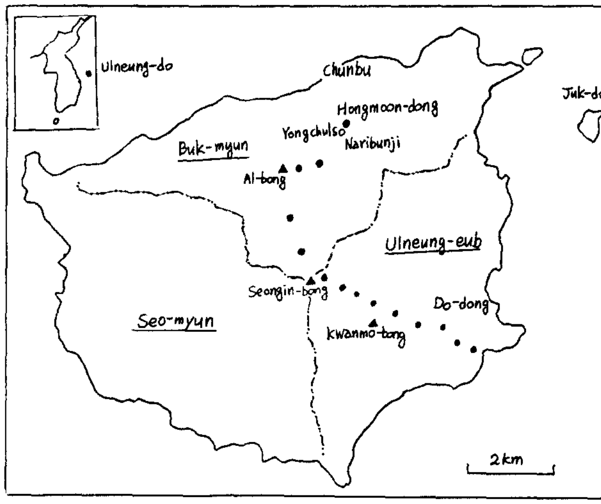

Fig. 1. Investigsted location, Ulneungdo, Korea.

Table 1. Altitude, forest type and soil properties of samples in island Ulneungdo

Site	Ul 1	Ul 2	Ul 3	Ul 4	Ul 5	Ul 6	Ul 7	Ul 8
Altitude(m)	185	290	370	460	670	700	900	960
Forest type	*Magnolia sieboldii*	*Pinus densiflora*	*Sasa* cattle dung	*Alnus maximowiczii*	*Fagus crenata* var.	*Rumobra mutica*	*Sasa rumobra*	*Alnus Acer*
Water content(%)	39.3	59.8	72.6	55.6	53.7	52.0	52.4	53.6
Organic matter(%)	16.7	26.2	15.2	23.9	30.3	26.7	26.1	28.9
pH	6.23	5.74	7.13	5.33	5.52	4.92	4.57	5.03

Site	Ul 9	Ul 10	Ul 11	Ul 12	Ul 13	Ul 14	Ul 15
Altitude(m)	920	700	460	450	380	240	240
Forest type	*Sorbus commixta*	*Fagus crenata* var.	*Alnus maximowiczii*	*Alnus Pinus*	*Acer okamotoanum*	*Pinus densiflora*	manure cattle dung
Water content(%)	48.0	44.9	47.8	59.1	59.6	56.3	79.1
Organic matter(%)	29.1	24.5	30.0	29.0	22.9	32.5	16.1
pH	6.19	5.93	5.03	5.14	6.54	6.33	8.66

ganic matter and soil pH of collecting sites, are shown in Table 1.

RESULTS AND DISCUSSION

Thirty-nine isolates were found from forty-five soil samples of fifteen sites including forests, herbs and cattle dung and manure in island Ulneungdo, South Korea (Table 2). They were identified and classified into thirteen dictyostelid cellualr slime molds. They were ten species including *Dictyostelium aureo-stipes* var. *aureo-stipes*, *D. brefeldianum*, *D. macrocephalum*, *D. caudabasis*, *D. sphaerocephalum*, *D. giganteum*, *D. crassicaule*, *Polysphondylium pallidum*, *P. violaceum* and *P. tenuissimum* and three species unidentified. *D. aureo-stipes* of them was dominantly prevailed against

Table 2. Occurrence of cellular slime molds in island Ulneungdo

Species \ Site	Uld 1		Uld 2		Uld 3		Uld 4		Uld 5		Uld 6		Uld 7		Uld 8		Uld 9	
	F[1]	D	F	D	F	D	F	D	F	D	F	D	F	D	F	D	F	D
D. aureo-stipes	–	–	–	–	100	70	–	–	100	100	100	91	66	30	78	63	33	50
P. violaceum	–	–	50	68	100	11	33	18	–	–	–	–	100	70	–	–	–	–
P. tenuissimum	–	–	–	–	66	12	33	11	–	–	–	–	–	–	–	–	33	50
D. brefeldianum	100	100	–	–	–	–	–	–	–	–	–	–	–	–	44	22	–	–
P. pallidum	–	–	–	–	33	3	–	–	–	–	33	9	–	–	–	–	–	–
D. crassicaule	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. sphaerocephalum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22	15	–	–
D. sp-U11	–	–	–	–	–	–	100	71	–	–	–	–	–	–	–	–	–	–
D. sp-U12	–	–	–	–	–	–	66	50	–	–	–	–	–	–	–	–	–	–
D. macrocephalum	–	–	33	32	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. sp-U13	–	–	–	–	–	–	–	–	–	–	33	51	–	–	–	–	–	–
D. caudabasis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
D. giganteum	–	–	–	–	33	4	–	–	–	–	–	–	–	–	–	–	–	–
Total clones(No. /g)	1,009		5,593		16,151		7,001		4,717		13,034		6,934		4,236		3,734	

Species \ Site	Uld 10		Uld 11		Uld 12		Uld 13		Uld 14		Uld 15		RD[2]	SF	AF	IV
	F	D	F	D	F	D	F	D	F	D	F	D				
D. aureo-stipes	–	–	50	7	–	–	100	83	–	–	100	100	46	60	48	67
P. violaceum	–	–	83	9	100	31	66	17	–	–	–	–	16	47	35	38
P. tenuissimum	–	–	–	–	–	–	–	–	33	21	–	–	6	27	11	17
D. brefeldianum	–	–	66	77	–	–	–	–	–	–	–	–	9	13	14	15
P. pallidum	–	–	17	7	–	–	–	–	33	27	–	–	4	27	8	14
D. crassicaule	50	90	–	–	–	–	–	–	–	–	–	–	9	7	3	9
D. sphaerocephalum	–	–	–	–	33	19	–	–	–	–	–	–	2	13	4	7
D. sp-U11	–	–	–	–	–	–	–	–	33	1	–	–	<1	13	9	7
D. sp-U12	–	–	–	–	66	50	–	–	–	–	–	–	3	7	4	6
D. macrocephalum	–	–	–	–	–	–	–	–	–	–	–	–	2	7	2	4
D. sp-U13	–	–	–	–	–	–	–	–	33	51	–	–	2	7	2	4
D. caudabasis	33	10	–	–	–	–	–	–	–	–	–	–	1	7	2	4
D. giganteum	–	–	–	–	–	–	–	–	–	–	–	–	<1	7	2	3
Total clones(No. /g)	8,634		7,517		4,901		5,943		4,211		184					

[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
SF(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

others. In particularly, three of genus *Polysphondylium* species distributed widely in Korea, occurred. It was thought that species diversity was comparatively higher.

D. aureo-stipes var. *aureo-stipes* and *P. violaceum* prevailed in deciduous forests and conifers as well as cattle dung. But *D. brefeldianum* was found in only deciduous forests. Total clones and the number of species were more in deciduous forests and conifers. Moore and Spiegel (1995) suggested that there appeared to be no correlation between plant community type and mycetozoan community type. But Chang *et al.* (1996a, b) and Hagiwara (1992b) reported the difference of the number of species isolated and total clones between them. It was thought that soil quality e.g. soil acidity and the amounts of organics and moisture, and prey bacteria were due to the profile of surface soil of forests. Soil samples from both site 3 and site 15 were cattle dung. More dictyostelids and total clones were isolated in site 3 than site 15. It may be resulted from soil basicity. *D. aureo-stipes* var. *aureo-stipes* was widely distributed in all elevations. But *P. violaceum* was not prevailed in near peak of island, Sunginbong and obtained from soil samples (370∼700m alt.). Such a difference seems due to climatic conditon.

적 요

경상북도 울릉군에 위치한 울릉도의 15개 지소에서 13종의 딕티오형 세포성 점균을 삼림 토양과 소똥에서 분리하였다. *Dictyostelium aureo-stipes* var. *aureo-stipes* (노랑산호팡이), *D. brefeldianum* (가는구슬팡이), *D. macrocephalum* (큰머리팡이), *D. caudabasis* (꼬리구슬팡이), *D. sphaerocephalum* (왕구슬팡이), *D. giganteum* (긴구슬팡이), *D. crassicaule* (좀고사리팡이), *Polysphondylium pallidum* (흰돌려난가지팡이), *P. violaceum* (자주돌려난가지팡이), *P. tenuissimum* (긴돌려난가지팡이) 등 10종과 미확인 종 3개였다. 최우점종은 *D. aureo-stipes* var. *aureo-stipes*로 다른 종에 비해 중요치가 월등하게 높게 나타났다. 그리고 특이하게도 *Polysphondylium* (돌려난가지팡이) 속 3개 종 모두가 널리 분포하였다. 울릉도의 종 다양성은 상당히 높은 것으로 사료된다.

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