Esculent Basidiomycetes in the Pinus densiflora Forest

by

M. MINAMIKAWA, T. HIRANO and T. ŌSAWA

Introduction

Japan extends to north and south. So various vegetation zones, i. e. subtropical, warm temperate, temperate and subarctic zone, are recognized in this country. In spring, summer and autumn, it is much rainfall and humidity, so that the forest fungi grow remarkably throughout the year. Recently the fungus has been regarded to be important as aromatic savory foodstuff and as sightseeing resources. Particularly *Tricholoma matsutake*, *T. aggregatum* and *Lentinus edodes* of *Basidiomycetes* are favorlite esculent fungi. As a result of reckless harvest and forest destruction, its production is decreasing year and year, so the persons concerned are promoting the research for the production increase, the artificial culture and the culture out of season of fungus.

The authors have investigated the environment, the ecology, the species, the chemical component and culture of fungus in many forests and fields. In this paper, the results of the research about esculent fungus growing in *Pinus densiflora* forest were reported as previous report. In the *P. densiflora* forest, it is concerned to grow *Tricholoma matsutake* as dominant and other fungi. However, there is, in fact, no research about this. The authors have investigated the ecology and to realize the production increas and the artificial culture of these fungi.

For the subject of investigation, mountains in Kinki and Tokai districts were selected since near to the laboratory. In this paper it was reported what the authors investigated the forest of Suzuka mounfains lying on Mie, Shiga and Gifu prefectures.

Methods

Pinus densiflora forest in the area to be researched was investigated fully about the composition of the forest, and the forest was classified into various Faciation. The classified *P. densiflora* forest was investigated with fungus. Among many kinds of fungus the esculent fungi were picked up and arranged.

Composition of the Forest in which the Fungi Grow

The forests of *P. densiflora* in which esculent fungi grow exist within the range of Awomori prefacture and Yakushima island, Kagoshima prefecture. Vertical distribution of the forest is observed up to 1,200 meters above the sea.

This time, the plant community in *P. densiflora* forest was investigated at Suzuka mountains.

From a phytosociological viewpoint, the forests belong to *Rhodoreto-Pinetum densiflorae*. Moreover, the forests were classified into various Faciation by the difference of growth stage and environment. Namely following Faciations grew, i. e. (1) Subass *rhodoretosum* whose differential species were *Rhododendron reticulatum, Pieris japonica* and *Illicium anisatum*. (2) Subass *quercetosum* that grew frequently on the remains of felling the *P. densiflora* forest on plain or hill. (3) Subass *miscanetosum* formed mainly on the remains of a meadow on the flat top of a mountain or a fan at the foot of a mountain. (4) Subass *sasetosum* observed mainly on the narrow ridge. (5) Subass *cyclobalanopsidetosum* of a subsere in the area whose climatic climax was *Sakakieto-Shiietum Caspidatae* and which formed on the range of a hill and the foot of a mountain. And (6) Subass *dicranopteridetosum* whose differential species was *Dicranopteris dichotoma*.

Fungus in the *Pinus densiflora* Forest

a) Fungus in Winter

In the *P. densiflora* forest on Suzuka mountains, even in snowdrift season, *Tricholoma pinetorum* grew on the bare ground and *Mycena laevigata* on the rotten wood. Among *Hypnum plamaeforme, Dumortiera hirsuta* and *Ctenidium capillifolium, Galoria clovata* grew.

b) Fungus in Spring

In springtime, *Mycena pura* and *Morchella conica* grew on the earth. On the fallen leaves and twigs on forest floor, *Galerina pseudocamerina* and *G. marginata* grew. *Naematoloma fasciculare* and *Onnia crientalia* grew on the fallen trees and dead ones. *Galorina hypnorum* was observed among the mosses of *Leucobryum scabrum, Hypnum plumaeforme, Dicranum japonicum*.

c) Fungus Observed from Summer to Early Autumn

In *P. densiflora* forest, a large number of fungi were observed from middle of August to late September. In the first place, *Russula lepida, R. delica, R. nigricans, R. cyanoxantha, R. adusta* belong to *Russula* and *Tylopilus felleus, T. areolatus, Lactarius vellereus, L. loccata* and *L. volenus* began to grow in early July. Middle in July, a large number of *Russula, Tylopilus* and *Lactarius* were observed in these forests. Since the season that was low temperature in morning and evening, however, these genera of the fungus decreased rapidly. In late August, the fungi to be observed in Autumn began to grow. The species of fungi that grew in this season were as follows.

Fungi on the earth in the forest ; *Lactarius piporatus, L. volemus, L. laccata, L. hatsudake, L. vellereus, Russula delica, R. nigricans, R. cyanoxantha, R. lepida, R. adusta, Amanita, A. echinocephala, A. rabescens,*

Gomphidius roseus, G. rutilus, Lentinus lepidius, Boletus vilaceofuscus, Hygrocybe amoena, H. punicea, Tricholoma vigatum, Suillus bovinus, S. luteus, Tylopilus virens, T. areolatus, T. felleus, Boletellus retisporus, Borphyrellus subvirens, Paxillus atrotomentosus, Inocybe praetervisa, Asterophora lycoperdoides and *Rhodophyllus nitidus.*

d) Fungus in Autumn

When atmospheric temperature became low in autumn, a large number of fungus grew in every forest, especially in *P. densiflora* forest.

On the forest floor in *P. densiflora* forest : *Tricholoma matsutake, T. robustum, T. portentosum, T. flavovirens, T. ustale, T. albobrunneum, Bletopsis leucomelas, Lactarius chrysorrheus, Rozites caperata, Cantharellus minor, Cortinarius turmalis, C. vibratilis, C. collinitus, C. pseudopurpurascena, C. cinnamomeus, Clavaria purpurea, Hygrophoropsis bicolor, Boletellus retisporus, Russula metachroa, R. xerampelina* and *Amanita pantherina.*
On the fossil wood in the forest floor : *Pholiota spumosa, Hygrophoropsis bicolor* and on the withered trees : *Cryptoporus volvatus, Hericium erinaseum* and *Pholiota squarrosa.*

e) Esculent Fungus in *Pinus densiflora* Forest

The species grown on the forest floor in *P. densiflors* forest were as follows : *Tricholoma matsutake, T. robustum, T. portentosum, T. flavovirens, T. albobrunneum, Lactarius Hatudake, L. chrysorrheus, L. piperatus, L. volumus, L. laccata, Boletopsis leucomelas, Rozites caperata, Cantharellus minor, Cortinarius turmalis, C. cinnamomeus, Clavaria purpurea, Russula delica, R. nigricans, R. cyanoxantha, R. lepida, R. adusta, Gomphidius roseus, G. rutilus, Lentinus lepideus, Boletus violaceofuscus, Hygrocybe amoena, H. punicea, Trichlomopsis rutilana, Suillus bovinus, S. lateus* and *Mycena pura.*

Fungi grown on the withered trees, the fallen twigs, fallen trees, fossil woods and the litter in *P. densiflora* forest were as follows : *Pholiota spumosa, P. squarrosa, Galorina marginata* and *Tricholomopsis rutilana.*

f) Classification of Fungus with Faciation

With observation of *P. densiflora* forest, six Subass were classified. It was recognized to be distinctive fungi in each Faciation. *Boleetellus retisporas, Lactarius vellereus, Boletus violaceofuscus* and *Cortinarius pseudopurpurascena* were observed more in the forest of Subass *quercetosum* than in other Faciation. In the forest of Subass *Cyclobalanopsidetosum, Tylopilus virens, Porphyrellus sabrirens* and *Cortinarius pseudopurpurascena* were distinctive species. *Hygrocybe punicea* and *Morchella conica* were observed in the forest of Subass *Micanetosum. Hygrocybe amoena* was observed in the forest of Subass *Sasetosum. Inocybe subvolvata* and *Tylopilus areolatus* were in the forest of Subass

Dicranopteridetosum.

Summary

The excellent esculent fungi such as *Tricholoma matsutake* and others were observed to grow in the *Pinus densiflora* forest. The authors observed the fungi growing in *P. densiflora* forest of Suzuka mountains.

1) From the viewpoint of Faciation, the forest of Suzuka mountains belong to the forest of *Rhodoreto-Pinetum densiflorae*. These forests were classified into following six Subassociations, i. e. Subass *rhodoretosum*, Subass *quercetosum*, Subass *cyclobalanopsidetosum*, Subass *micanetosum*, Subass *sasetosum* and Subass *dicranopteridetosum*

2) In *P. densiflora* forest, *Tricholoma pinetorum* and other fungi grew even in snowdrift season. *Mycena pura* and other fungi grew in spring. *Russula* and other many species of fungi were observed in summer. From late summer to autumn, the excellent esculent fungi such as *Tricholoma matsutake* were observed.

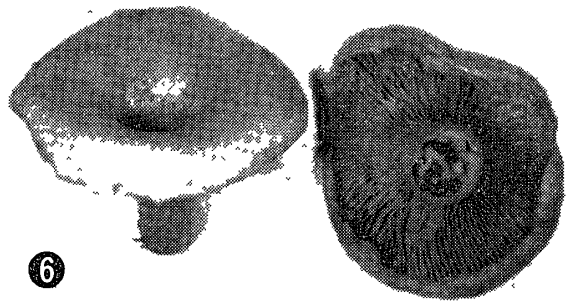
3) Thirty species of the esculent fungi were on the forest floor and four species were on the woods.

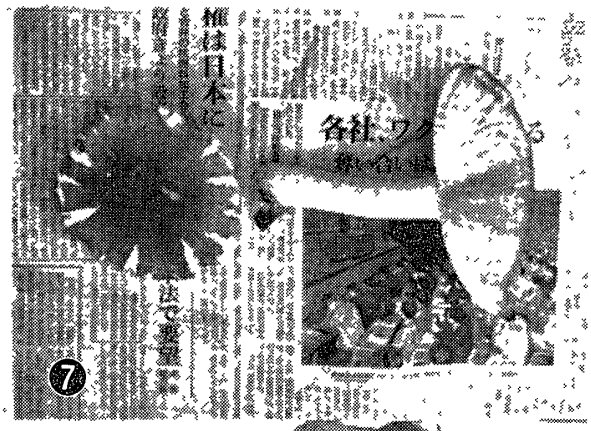
4) The fungi to be observed in *P. densiflora* forest were three species in winter, seven species in spring, fortyone species from summer to autumn and twentysix species in autumn.

5) The distinctive species of fungi were observed in every Faciations.

References

1) Hamada, M : Univ Kyoto, 1960.
2) Hongo, T : Matsutake, 1964
3) Hongo, T : Univ Shiga, 10
4) Imai, S : Yokohama Nat Univ , 1955
5) Minamikawa, M and Yatoh, K : Mie Univ , 1963





1 *Tricholoma matsutake*

2 *T flavovirens*

3 *Rozites caperata*

4. *Lyophyllum aggregatum*

5 *Boletus* spp

6. *Lactarius vellereus*

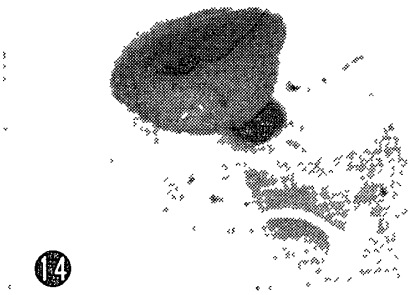
7 *Russula lepida*

8 *Russulaceae*

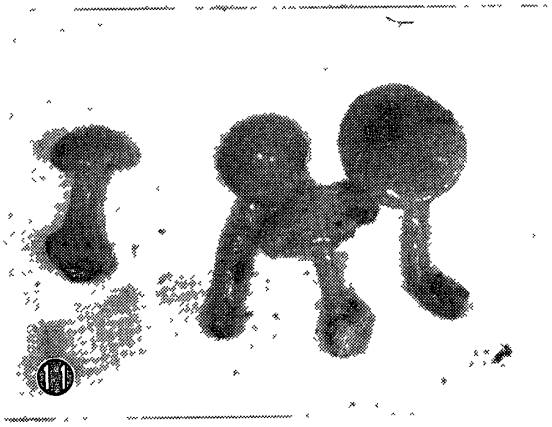
9

13

10



14



11

15

12

16

9 *Leccinum rugosiceps*

10 *Cortinarius cinnamomeus*

11 *Pholiota labrica*

12 *Naematoloma sublateritium*

13 *Tricholomopsis rutilans*

14 *Tricholoma albobrunneum*

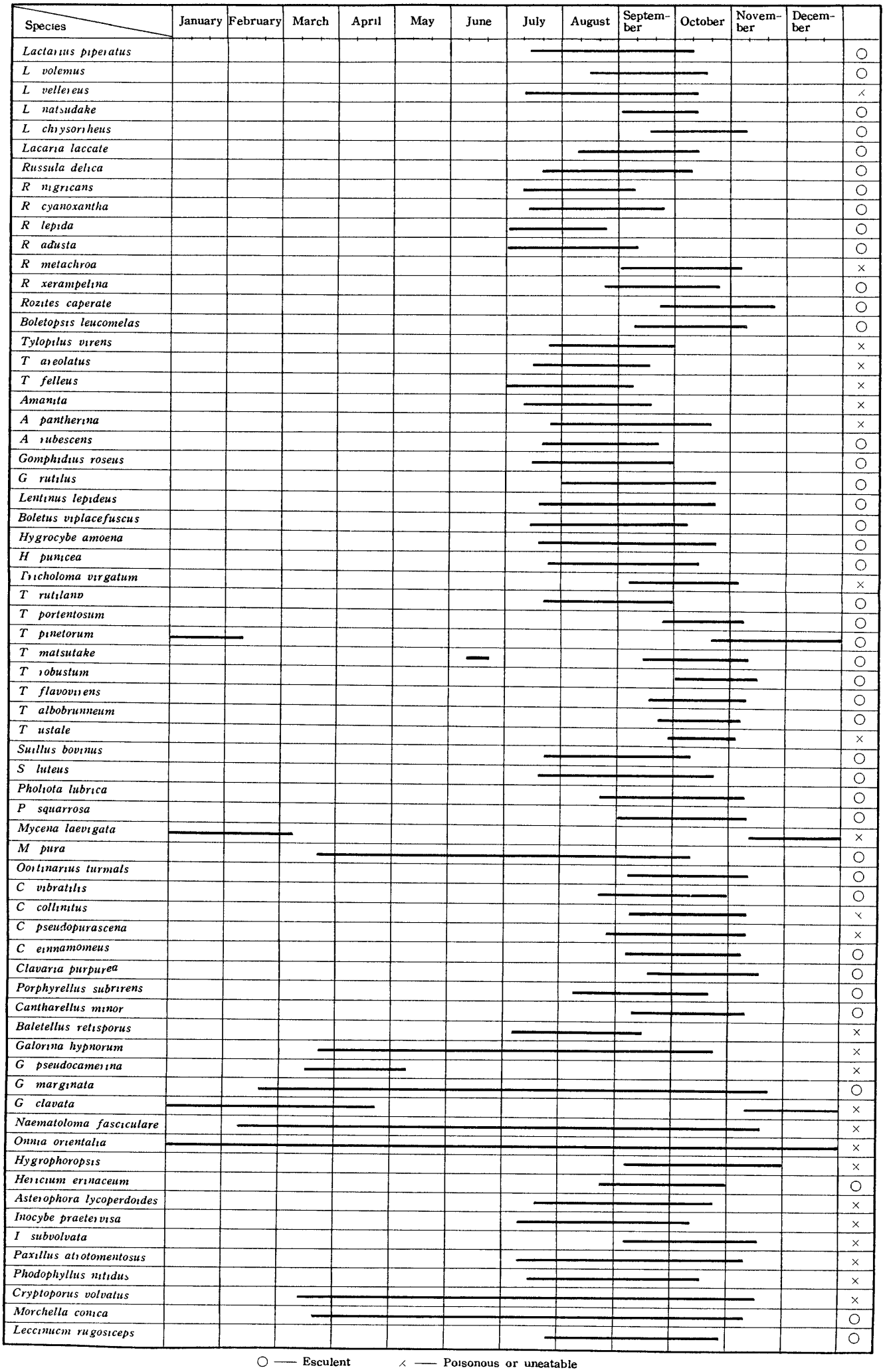
15 *Tricholoma sejunctum*

16 *Morchella conica*

Summarized association table of *Pinus densiflora* forest (Mt Suzuka)

	Association	*Rhodoreto-Pinetum densiflorae*															Average cover degree	Presence
		rhodoretosum					*quercetosum*				*miscanetosum*		*sasetosum*		*cyclobalanopsidetosum*			
	Locality	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮		
	Altitude (m)	430	390	420	450	510	230	150	620	310	925	540	680	710	320	340		
	Exposition	SE	E	SE	W	SE	SE	ES	E	NE	SE	SE	SE	SE	E	E		
	Slope degree	28°	20°	31°	21°	25°	12°	5°	18°	15°	5°	22°	14°	21°	18°	20°		
	Quadrat number	96	56	209	210	212	34	218	59	74	11	79	202	207	173	217		
Tree layer	*Pinus densiflora*	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	4 9	V
	Prunus Jamasakura	+	+	+	+	+	+	·	·	·	·	·	+	·	·	·	+	II
	Cyclobalanopsis acuta	·	1	·	·	·	·	·	·	·	·	·	+	·	1	+	0 1	II
	Acer palmatum	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	II
Subtree layer	*Quercus serrata*	·	·	+	2	+	+	+	·	+	·	·	·	·	·	·	0 1	III
	Pieris japonica	·	·	·	·	+	+	+	·	+	1	+	·	·	·	·	0 1	II
	Clethra barbinervis	·	·	·	·	·	·	·	+	·	+	1	·	·	·	·	0 1	II
	Ilex crenata	1	+	+	+	·	+	+	·	·	·	·	·	·	·	·	0 1	II
	Camellia japonica	·	+	+	·	·	·	·	·	·	·	+	+	·	+	+	+	I
	Cyclobalanopsis glauca	·	+	·	·	+	+	·	·	·	·	·	+	·	+	·	+	I
	Acer palmatum	+	·	+	+	+	·	+	+	·	·	·	·	·	·	·	+	I
	Cyclobalanopsis acuta	+	+	·	·	+	·	·	·	·	·	·	+	+	·	+	+	I
	Castanopsis cuspidata	·	·	·	·	·	+	+	·	·	·	·	·	·	+	+	+	I
	Tsuga Sieboldii	+	+	+	+	·	·	·	·	·	·	·	+	+	·	+	+	I
Shrub layer	*Rhododendron reticulatum*	4	3	2	2	3	+	1	+	+	+	+	+	+	+	+	1 0	V
	Quercus serrata	+	+	+	1	+	4	3	3	3	·	+	·	·	·	·	1 0	V
	Rhododendron Kaempferi	+	+	+	+	+	2	1	1	1	1	1	+	+	+	+	0 5	IV
	Pieris japonica	1	1	+	+	+	1	+	+	+	·	·	+	·	1	1	0 3	II
	Ilex crenata	+	+	+	+	+	+	+	+	·	1	1	+	+	+	·	0 1	II
	Lyonia elliptica	+	+	·	+	+	1	+	+	+	+	+	·	·	+	+	0 1	II
	Pourthiaea villosa var *laevis*	+	+	1	+	·	+	+	+	+	·	·	·	+	+	+	0 1	II
	Lespedeza cyrtobotrya	·	·	·	·	·	+	1	+	+	·	·	·	·	·	·	0 1	II
	Illicium anisatum	1	+	+	+	+	·	·	·	·	·	·	·	·	+	+	0 1	II
	Cleyera japonica	+	·	·	·	·	+	·	·	+	·	+	·	·	1	+	0 1	II
	Sasa nipponica	·	+	·	·	·	·	·	·	·	1	1	4	3	·	·	0 6	II
	Nipponocalamus pygmaeus	·	·	·	·	·	1	1	1	+	·	·	+	·	+	+	0 2	II
	Fraxinus lanuginosa var *serrata*	+	+	·	+	+	+	+	+	+	·	+	+	·	+	+	+	I
	Castanea crenata	+	+	+	+	+	+	·	+	+	·	+	·	·	+	+	+	I
	Lindera umbellata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	I
	Rhus trichocarpa	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	I
	Pertya scandens	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	+	I
	Abelia Spathulata	+	+	+	+	+	+	+	+	+	·	·	+	·	+	+	+	I
	Ilex pedunculosa	+	+	+	+	·	+	·	+	·	·	·	·	·	+	+	+	I
	Hydrangea hirta	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	I
	Viburnum erosum	+	+	+	+	+	+	+	+	+	·	+	·	+	·	·	+	I
	Tripetaleia paniculata var *latifolia*	+	+	+	+	+	+	·	+	·	+	+	+	·	+	+	+	I
	Rhododendron macrosepalum	·	·	+	·	+	·	+	·	+	·	+	·	·	+	+	+	I
	Lespedeza Buergeri	+	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	I
	Vaccinium Smallii var *glabrum*	+	+	+	·	+	+	+	+	+	+	·	·	·	·	·	+	I
	V bracteatum	·	·	·	+	+	+	+	+	+	·	+	·	+	+	+	+	I
	Lindera oblusiloba	·	·	·	+	·	·	+	·	·	+	+	·	·	+	·	+	I
	Cyclobalanopsis acuta	+	+	+	·	+	·	·	·	·	·	+	+	·	·	·	+	I
Herb layer	*Schizocodon soldanelloides* var *magnus*	+	+	+	+	+	+	·	·	·	·	·	+	·	·	+	+	I
	Disporum smilacinum	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	+	I
	Cymbidium virescens	+	+	+	+	+	+	+	+	+	+	+	+	·	+	·	+	I
	Struthiopteris niponica	+	+	+	+	+	+	+	+	+	+	+	·	+	+	+	+	I
	Metanarthecium luteo-viride	+	+	+	+	+	+	+	+	+	+	·	+	·	·	·	+	I
	Solidago Virga-aurea subsp *asiatica*	+	+	+	+	+	·	·	·	·	+	+	·	·	·	·	+	I
	Chrysanthemum Makinoi	+	+	+	+	+	+	+	·	·	·	+	·	·	·	·	+	I
	Lycopodium serratum	+	+	+	+	·	·	·	·	+	+	·	·	+	·	·	+	I
	Pyrola japonica	+	+	+	+	+	+	+	+	+	+	+	·	·	·	+	+	I
	Dicranopteris dichotoma	·	·	·	·	·	+	+	+	+	+	·	·	·	+	+	+	I
	Miscanthus sinensis	·	·	·	·	·	+	1	+	+	3	3	·	·	·	·	0 5	I
	Pteridium aquilinum var *latiusculum*	·	·	·	·	·	+	+	+	+	1	1	·	·	·	·	0 1	I
	Haloragis micrantha	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	+	I
	Arundinella hirta	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	+	I
	Artemisia princeps	·	·	·	·	·	+	·	·	·	+	+	·	·	+	·	+	I

The Growth Period of Fungus in *P densiflora* (Suzuka mountains)



○ —— Esculent　　× —— Poisonous or uneatable