On the Distribution of the Population with Idioblasts in Needle of Pinus Subgenus Haploxylon in Japan

On the Distribution of the Population with Idioblasts in Needle of *Pinus* Subgenus *Haploxylon* in Japan

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ABSTRACT : Needle sample were collected from 38 populations of *P. pumila*, 38 of *P. parviflora* and 10 of *P. hakkodensis*. Idioblasts were found in mesophyll of the needles in 18 populations of these three taxa. This contradicts Ishii's report (1941) that idioblast is one of the most distinct characters separating "kubinagahaimatsu" on Mt. Kattadake from the other taxa of five leaved pines in Japan.

Key words : Idioblast, Needle anatomy, *Pinus* subgenus *Haploxylon*.

Introduction

Ishii (1941) recognized a new type of *Pinus*, "kubinagahaimatsu", for the plants characterized by a cone stalk longer than 1cm and the presence of idioblast in the needle mesophyll. These plants were reported from Mt. Kattadake in the Zao Range. He believed that "kubinagahaimatsu" was intermediate between *P. pumila* and *P. parviflora*, but more closely related to *P. pumila*. Since then, only a few studies on the taxonomic significance of the presence of idioblast in the "kubinagahaimatsu" needle have been conducted.

Sato (1993a) reported that several idioblasts were found in the needle samples of both *P. pumila* and TENGU-type of *P. hakkodensis*, collected on Mt. Tateyama. But these plants could not be regarded as "kubinagahaimatsu" type because their cone-stalk was shorter than 1cm (Sato 1993b).

The purpose of this paper is to explain the geographical distribution of *Pinus pumila* and its relatives whose needles contain idioblast in mesophyll, and to consider the taxonomical value of this needle character. In this paper I will use the name *P. hakkodensis* to refer to the group of intermediate types between *P. parviflora* and *P. pumila*.

Materials and Methods

Needle samples were collected from 38 populations of *P. pumila*, 38 populations of *P. parviflora* and 10 populations of *P. hakkodensis*. Twenty or more one-year-old needles were sampled in each population. The central part of the needle was sectioned and examined under the light microscope for idioblast.

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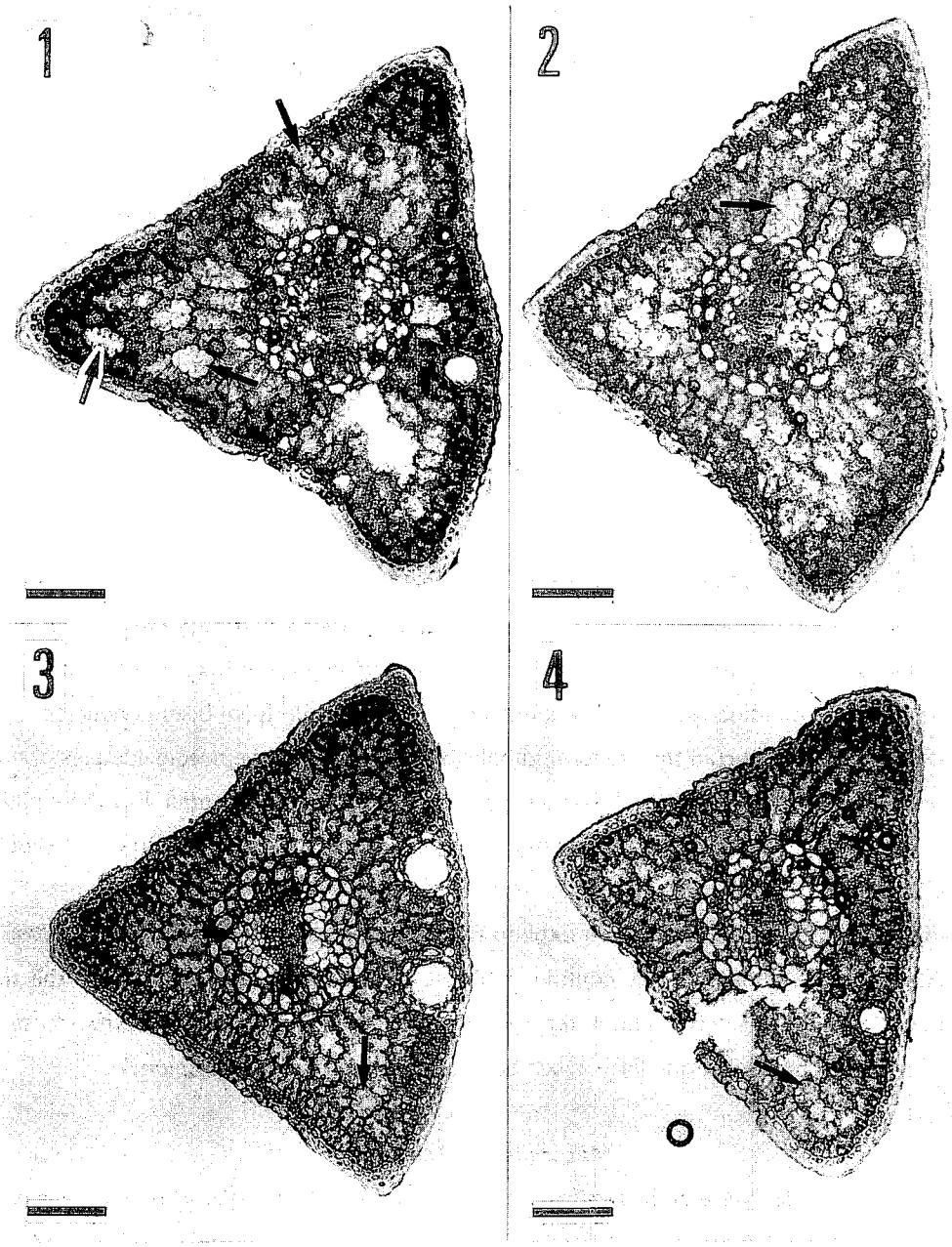
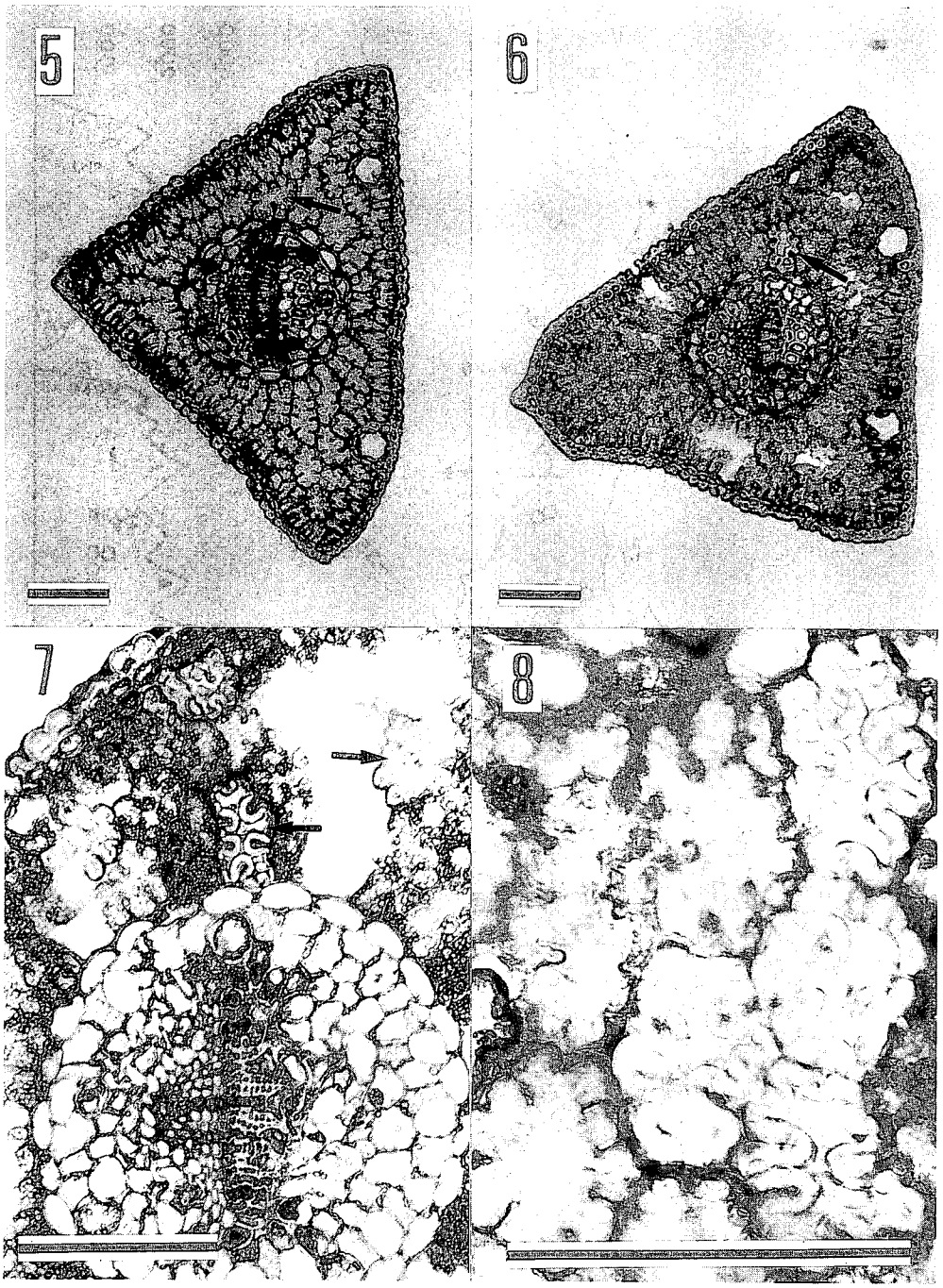


Figs. 1-8. 1 Mt. Kattadake ; 2 Mt. Maeyama ; 3 Kemutai ; 4 Sampokojinyama ; 5 Konashidaira ; 6 Ogimachi ; 7 Mimatsu ; 8 Tengu. Scale 0.1mm.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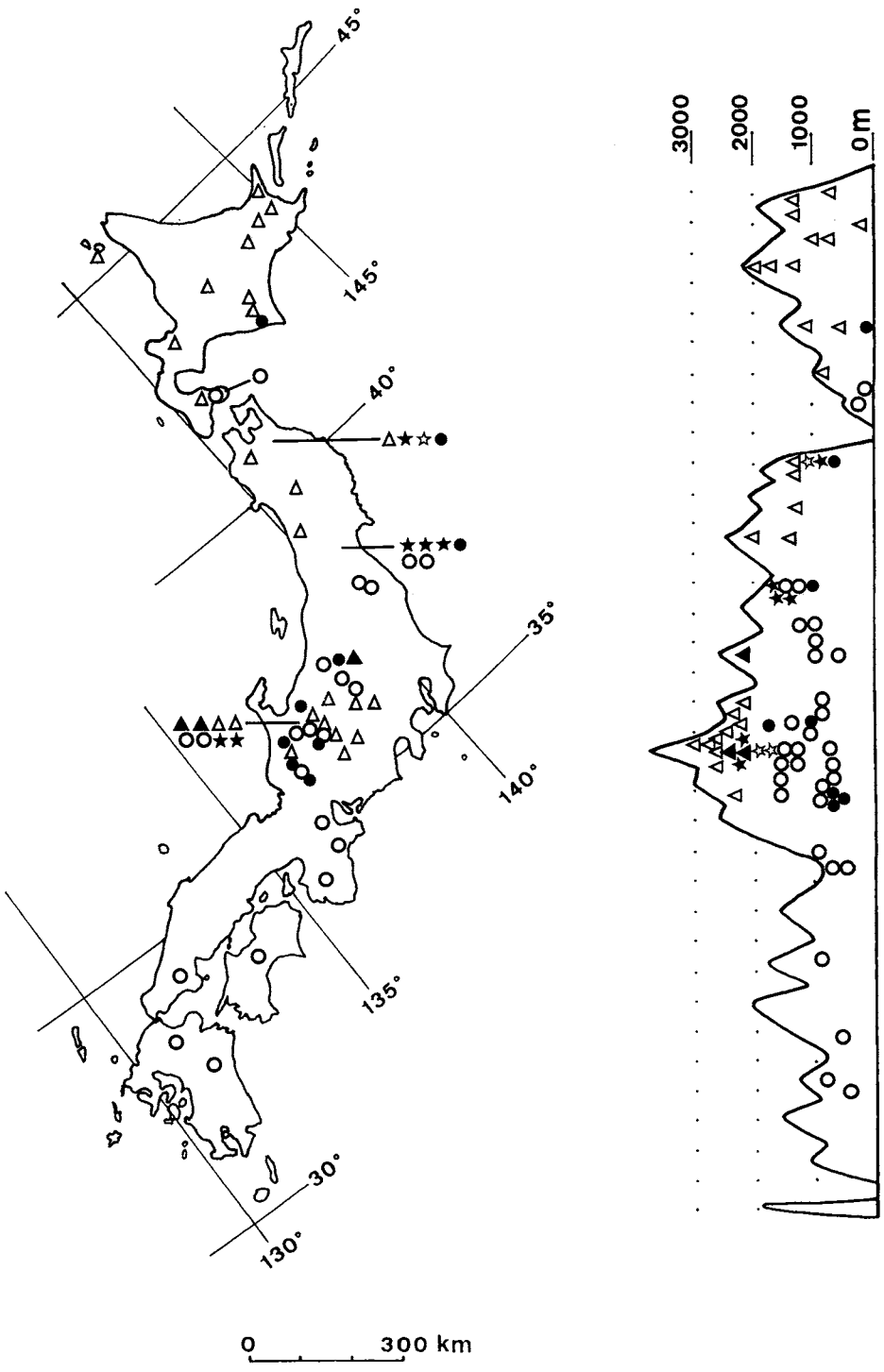

Fig. 9. The distribution of populations of five-leaved pine with/without idioblast. △, ▲ *P. pumila* ; ☆, ★ *P. hakkodensis* ; ○, ● *P. parviflora*. Solid with idioblast ; open without idiobalst.

Table 1. Frequency distribution of the number of idioblast in mesophyll of five leaved pine needle

Population	Lat. (°)	Alt. (m)	Tree form	IF (%)	MNI	Attributable taxa
Esso	55.9	600	C	0	0	*P. pumila*
Musinai	52.6	1000	C	0	0	〃
Mt. Chersky	51.3	2000	A	0	0	〃
Mamai	51.3	900	A	0	0	〃
Mamai	51.3	710	A	0	0	〃
Baykalisk	51.3	460	A	0	0	〃
Mt. Rishiri	45.2	1500	C	0	0	〃
Mt. Rausudake	44.1	700	C	0	0	〃
Mt. Sharidake	43.8	1440	C	0	0	〃
Atosanupuri	43.8	190	A	0	0	〃
Mt. Kamihoro	43.4	1880	C	0	0	〃
Mt. Kamihoro	43.4	1260	A	0	0	〃
Mt. Meakan	43.4	960	A	0	0	〃
Mt. Meakan	43.4	720	C	0	0	〃
Mt. Teine	43.1	1010	A	0	0	〃
Mt. Horoshiridake	42.6	1950	C	0	0	〃
Mt. Apoi	42.1	600	C	0	0	〃
Mt. Yokotsudake	41.9	1090	A	0	0	〃
Mt. Tamochidake	40.5	1300	C	0	0	〃
Mt. Iwakisan	40.5	1250	A	0	0	〃
Mt. Hachimantai	39.9	1022	C	0	0	〃
Mt. Chokaisan	39.1	2000	C	0	0	〃
Mt. Chokaisan	39.1	1300	C	0	0	〃
Mt. Shibutudake	36.9	2200	C	45.0	7.2	〃
Mt. Motoshiraneyama	36.7	2040	C	0	0	〃
Mt. Tonbi	36.6	2600	A	0	0	〃
Murodo-A	36.6	2450	C	0	0	〃
Murodo-B	36.6	2400	C	0	0	〃
Ootani	36.6	2310	C	19.0	1.8	〃
Mimatsu	36.6	2080	C	46.2	4.8	〃
Mt. Nishihodakadake	36.4	2450	C	0	0	〃
Mt. Hakusan	36.2	2300	C	0	0	〃
Mt. Norikura	36.1	2610	C	0	0	〃
Mt. Norikura	36.1	2410	C	0	0	〃
Mt. Yatsugatake	36.0	2450	C	0	0	〃
Mt. Ontake	35.9	3090	C	0	0	〃
Mt. Kinpu	35.9	2470	C	0	0	〃
Mt. Komagatake	35.8	2600	C	0	0	〃
Mt. Apoi	42.1	200	E	10.0	1.0	*P. parviflora*
Mt. Esan	41.8	420	A	0	0	〃
Kamieyama	41.8	70	E	0	0	〃
Jokuradani	40.5	700	E	30.0	1.0	〃
Mt. Sanpokojinyama	38.1	1700	A	0	0	〃
Kanshodaira	38.1	1420	E	0	0	〃
Komakusadaira	38.1	1180	E	5.0	1.0	〃
Goyomatsudaira	37.6	1340	A	0	0	〃
Dakeonsen	37.6	960	E	0	0	〃
Oritate	37.3	350	E	0	0	〃
Okutadami	37.2	800	E	6.3	2.0	〃

Population	Lat. (°)	Alt, (m)	Tree form	IF (%)	MNI	Attributable taxa
Naramata	36.9	840	E	0	0	〃
Kubo	36.8	650	E	0	0	〃
Happo-one	36.6	1700	A	10.0	1.0	〃
Daikanbo	36.5	1620	E	0	0	〃
Shimonokodaira	36.5	1460	E	0	0	〃
Ozanamigozen	36.5	650	E	0	0	〃
Mt. Sirokomine	36.4	1580	A	0	0	〃
Mt. Sirokimine	36.4	1320	E	0	0	〃
Arimine	36.4	1100	E	0	0	〃
Takanbo	36.4	520	E	10.0	3.0	〃
Mt. Sanpokuzureyama	36.3	1740	A	0	0	〃
Ogimachi	36.3	540	E	20.0	1.0	〃
Urushikakiuchi	36.2	650	E	0	0	〃
Ueno	36.2	500	E	0	0	〃
Hikagedaira	36.1	1500	E	0	0	〃
Konashidaira	36.1	1100	E	20.0	1.5	〃
Mihoro	36.1	700	E	0	0	〃
Nishido	35.9	720	E	0	0	〃
Takigoshi	35.8	1100	E	0	0	〃
Asahi	35.7	400	E	63.6	1.6	〃
Gozaishoyama	35.0	960	E	0	0	〃
Ryugadake	34.3	450	E	0	0	〃
Koyasan	34.2	720	E	0	0	〃
Oosugidani	34.2	380	E	0	0	〃
Higashikuromori	33.8	960	E	0	0	〃
Hikosan	33.5	920	E	0	0	〃
Ohira	32.8	540	E	0	0	〃
Kemutai	40.5	1200	A	0	0	*P. hakkodensis*
Kemutai	40.5	1020	A	5.0	4.0	〃
Mt. Kattadake	38.1	1700	C	100.0	7.9	〃
Mt. Maeyama	38.1	1660	C	60.0	3.1	〃
Mt. Maeyama	38.1	1600	A	5.0	6.0	〃
Tengu	36.6	2310	C	60.0	6.2	〃
Kagamiishi	36.6	2250	C	59.1	1.6	〃
Oiwake	36.6	1900	A	0	0	〃
Nanamagari	36.6	1740	A	0	0	〃
Kaminokodaira	36.6	1620	A	0	0	〃

Tree form : C　creeping ; A　ascendent ; E　erect ; IF　idioblast frequency ; MNI　mean number of idioblast.

Table 2.　Number of populations in which indioblasts were found in needle mesophyll

		Number of populations		
		present	absent	Total
Taxon	*P. pumila*	3	35	38
	P. hakkodensis	6	4	10
	P. parviflora	9	29	38
Tree form	Creeping	7	24	31
	Ascendent	3	20	23
	Erect	8	24	32

Results and Discussion

The idioblast in mesophyll are shown in Figs. 1-8. The size of the idioblast is almost same as normal mesophyll cells, but it has lignified cell walls and no protoplasm.

The frequency of needles with idioblast in each population and the mean number of idioblast in a cross section are shown in Table 1. Needles with idioblast were found in 18 populations belonging to three taxa; this contradicts Ishii's report (1941) that idioblast is one of the most distinct characters separating "kubinagahaimatsu" on Mt. Kattaddake from the other taxa of five leaved pines in Japan. The number of populations with idioblasts in each taxon and tree form is shown in Table 2. Because the frequency of populations with idioblasts in *P. hakkodensis* is higher than that of other taxa (χ^2-test, $P < 0.001$), it is possible that the presence of idioblast is not only the characteristic for the "kubinagahaimatsu", but also common feature for *P. hakkodensis*. It is presumed that the presence of idioblast does not correlate with tree forms (χ^2-test, $P > 0.05$). The distribution of the populations of five leaved pines with/without idioblast is shown in Fig. 9. The populations of pine with idioblast are found in Hokkaido and eastern Honshu, and the range of those populations overlaps with the range of *P. pumila* and *P. parviflora*. The results of this study suggest that the presence of idioblast in mesophyll might be a key to understand the taxonomic relations among *P. parviflora* complex (Mirov 1967) including *P. pumila*, *P. hakkodensis* and *P. parviflora*.

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