

Powdery mildew of *Populus* spp. caused by *Phyllactinia guttata* (Wallr. ex Fr.) Lév¹

Chong Kyu Lee²· Kyeong Hee Kim²· Chang Keun Yi²

Phyllactinia guttata (Wallr. ex Fr.) Lév에 依한 포플러흰가루病¹

李鍾奎²· 金京姬²· 李昌根²

ABSTRACT

Powdery mildew has been observed on the several clones of *Populus euramericana*, *P. deltoides*, *P. deltoides* x *P. maximowiczii* in the nurseries of Chungcheongnam-do and Kangwoen-do Forest Research Institute in mid-October 1982. Powdery mildew fungus of *Populus* spp. was identified as *Phyllactinia guttata*(Wallr. ex Fr.) Lév which was reported as the powdery mildew fungus of *Populus tomentosa* Carr. Powdery mildew of *Populus* spp. caused by this fungus has not previously been reported in Korea. When we surveyed the occurrence of powdery mildew disease, the leaves of *P. deltoides* R-89 were severely attacked by this fungus.

Key words : powdery mildew; *Phyllactinia guttata*; perithecium; *Populus deltoides*; *P. euramericana*.

要 約

10月 中旬경, 忠清南道와 江原道 林業試驗場(大田, 春川) 묘포장 構內에서 흰가루病에 感染된 포플러 導入種. *Populus euramericana*, *P. deltoides*, *P. del* x *P. max.*의 여러 clone에서 採取한 病原菌을 形態의 特徵에 依하여 同定한 結果, *Populus* spp.에서는 *P. tomentosa* Carr.에서만 報告되어 있는 흰가루 病菌인 *Phyllactinia guttata* (Wallr. ex Fr.)로 同定되었고 *Populus* spp.에서 *Phyllactinia guttata*에 依한 흰가루 病은 우리나라에서는 처음으로 報告되었다. 發病狀況을 調査한 結果 *P. deltoides* R-89에서 가장 심하게 發病되었다.

INTRODUCTION

Powdery mildew has been observed on the upper and lower surfaces of *Populus euramericana*, *P. deltoides*, *P. del.* x *max.* leaves. Reports on the powdery mildew disease have been rarely found with the exception of "Disease of cultivated plants

in Korea" by Nukata and Takimoto, Park^{15, 16}, Kim^{8, 9}, Lee et al^{10, 11, 12}, Lee^{13, 14} in Korea.

It has been reported that *Uncinula salicis* (DC.) WINT and *U. adunca* (Wallr. ex Fr.) Lév were abundant on most of *Populus* spp., however, only Chinese white poplar (*Populus tomentosa* Carr.) was infected with *Phyllactinia guttata*¹⁷. *Uncinula salicis* has been reported on *Populus nigra* var. *italica*

¹ 接受 12月 13日 Received December 13, 1982.

² 林業試驗場 Forest Research Institute, Seoul, Korea.

Muenchh. and *Salix koraiensis* Anderson in Korea¹⁶⁾
and also on *Populus* spp. and *Salix* spp. in Japan.⁵⁾

RESULTS

MATERIALS AND METHODS

By mid-October 1982, fifty perithecia per clone from powdery mildew white spots formed on the both sides of *P. euramericana* Eco-28, V-211, *P. deltoides* R-89, P.E. 4-68, I-35/66, Lux I-69/55, and *P. del. x max.* I-83/58 leaves were obtained and the size and morphological characteristics of the perithecium, appendage, ascus and ascospore were observed under the light microscope.

The occurrence of powdery mildew disease for several clones were surveyed.

Powdery mildew white spots occurred only sparsely on the leaves of *Populus* spp. in mid-October (Fig. 1). However, under the cool temperature by late-October, the small, yellow, spherical perithecial initials appeared on the leaves and grow rapidly until the leaves fall down in early-November (Fig. 2). Mature perithecium was usually scattered, brown to dark brown, globose-depressed, and 180-260 μ in diameter (Fig. 3). They were spherical in face view and somewhat flattened in side view (Fig. 4). Around the outside of perithecium at the base, there was a ring of rigid, acicular, straight, aseptate, hyaline appendages with bulbous bases

Table 1. Morphological characteristics of *Phyllactinia guttata* on several host plants.

Reporter	Host plant	Conidia (μ)	Conidio- phore (μ)	Perithecium (μ)	Appendage		Ascus		Ascospore	
					Size (μ)	No.	Size (μ)	No.	Size (μ)	No.
Author	<i>Populus deltoides</i> <i>P. euramericana</i> <i>P. del. x P. max.</i>			180-260	170-255 (186.28)	6-11	47.5-77.5x 27.5-50.0 (64.38x 37.75)	8-16	20-35x 20-22.5 (29.25x 20.78)	2
Kapoor, J. N. ⁷⁾	Betulaceae Fagaceae Juglandaceae Acer, Populus Ribes, Salix, Ulmus	50-90x 10-20		160-230 (mostly below 200)	1-1½times of peri- thecium diameter	6-15	70-100x 25-40	8-25	25-45x 15-25	2 rarely 3
Hanlin R. T. ³⁾	<i>Philadelphus indorus var. grandiflorus</i>	69-104x 23-36 (87x30)	400x4	186-255 (212)	270x2-3		81-95x 30-44 (39x38)	numerous	35-53x 21-30 (43x26)	2
Lee. H. J. ¹²⁾	<i>Philadelphus tenuifolius</i>			89.6-127.1	20.5- 221.7x 2.4-3.8		16.1-51.7x 7.2-22.9	numerous	5.4-21.6 x2.7-10.8	numer- ous
Homma, Y. ⁵⁾				120-210	196-420	6-11	62.4-92.4x 30.0-45.6	8-18	28.8- 40.8x 16.8- 25.4	
Junell, L. ⁶⁾	<i>Carpinus betulus</i> <i>Corylus avellana</i> <i>Alnus glutinosa</i> <i>Alnus incana</i> <i>Betula pubescens</i> <i>Betula verrucosa</i> <i>Fagus sylvatica</i> <i>Fraxinus excelsior</i>			180-250	1-2 times of peri- thecium diameter	6-12		15-20		2-3

Table 2. Occurrence of poplar powdery mildew disease in the nurseries of Chungcheongnam-do and Kangwoen-do Forest Research Institute.

Species	Clone	Introduced year	Origin	Planted year in nurseries	Occurrence	
					Chungcheong nam-do	Kangwoen-do
<i>Populus deltoides</i>	R-89	1978	Italy	1981	+	++
	P.E.4-68	1975	"	"	+	+
	I-35/66	1955	"	"	+	-
	Lux I-69/55	1968	"	"	-	+
<i>P. euramericana</i>	Eco-28	1976	Italy	1981	+	+
	V-211	1959	Belgium	"	-	+
	I-476	1955	Italy	"	-	-
	I-214	1955	Italy	"	-	-
<i>P. del. x p. max.</i>	I-83/58			"	-	+

++ : Severely attacked by *Phyllactinia guttata*, + : slightly attacked, - : not attacked.

(Fig. 5). These appendages were 6-11 in number and 170-255 μ in length (average 186.28 μ) (Fig. 6). When the perithecium was fully matured, these appendages bent downward and then these lift perithecium from the surface of the leaf. Mature asci were hyaline, oval, contained two ascospores, and measured 47.5-77.5x27.5-50.0 μ (average 64.38x37.75 μ). Ascospores were hyaline, one-celled, ovoid, and averaged 29.25x20.78 μ (20.0-35.0x20.0-22.5 μ) (Fig. 7).

Based on the results obtained in this study, the powdery mildew fungus of *P. euramericana*, *P. deltoides*, *P. del. x P. max.* was identified as *Phyllactinia guttata* (Wallr. ex Fr.) Lév. (Table 1).

The occurrence of poplar powdery mildew was severe on the leaves of *P. deltoides* R-89. Powdery mildew did not occurred on *P. euramericana* I-214, I-476 although it occurred on *P. euramericana* Eco-28, V-211 (Table 2).

DISCUSSION

Unfortunately, it was impossible to observe the imperfect state (conidia, conidiophore) because of dry atmosphere and low temperature. However, by investigation on perfect state, *Phyllactinia guttata* which has previously been reported on only *Populus tomentosa* was observed on other *Populus* spp. in this study^{1,4,18,19}.

This fungus is different from *Uncinula salicis* which has been reported on *Populus nigra* var. *italica* and *Salix koraiensis* in Korea in morpholo-

koraiensis in Korea. *Phyllactinia guttata* has previously been reported on *Philadelphus tenuifolius* Rupr and Maxim in Korea¹². However, it seems that the identification of this fungus was not correct^{3,5,6,7}. Therefore, we believe that this fungus is reported in Korea by this research article for the first time despite of the fact that pathogenicity test by inoculation experiment and observation of imperfect state have not been accomplished². We also believe that this study is first report on powdery mildew of *Populus* spp. caused by *Phyllactinia guttata*.

Hereafter, it is suggested that the accurate investigations on pathogenicity test and imperfect state should be done.

LITERATURE CITED

- Alexopoulos, C. J. and C. W. Mims. 1979. Introductory mycology, 3rd Edition. "The *Phyllactinia* type centrum" John Wiley & Sons, Ins. 308-321.
- Boesewinkel, H. J. 1980. The morphology of the imperfect stage of powdery mildew (Erysiphaceae). The Bot. Rev. 46: 167-225.
- Hanlin, R. T. 1966. Powdery mildew on mock orange in Georgia. Plant Dis. Rep. 59(5):306-307.
- Ito, K. 1971. Pathology of forest trees(II). Norin Shuppan Co. Ltd. Tokyo, Japan. 9-21.
- Homma, Y. 1937. Erysiphaceae of Japan. J. Fac. Agric. Hokkaido(Imp.) Univ. 38:183-461.

6. Junell, L. 1967. Erysiphaceae of Sweden. Symb. bot. Ups. 19:1-117.
7. Kapoor, J. N. 1967. *Phyllactinia guttata*. C. M. I. description of pathogenic fungi and bacteria. Commonwealth Agricultural Bureaux, Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey, England.
8. Kim, K. C. 1965. Notes on powdery mildew of *Ailanthus altissima* caused by *Phyllactinia corylea*(Pers.) Karst. J. Kor. For. Soc. 4:9-13.
9. Kim, K. C. 1969. Perfect stage of *Microsphaera polygoni*(DC.) Sawada on *Robinia pseudoacasia* and its phylogenetic relationship to Gen. Erysiphaceae. J. Kor. For. Soc. 9:81-86.
10. Lee, H. J. and B. H. Lee. 1967. Unrecorded causal organisms of Korean Powdery. Kor. Jour. Microbiol. 5:24-33.
11. Lee, H. J. and B. H. Lee. 1969. Unrecorded causal organisms of Korean Powdery. Kor. Jour. Microbiol. 7:22-23.
12. Lee, H. J. and B. H. Lee. 1972. Unrecorded causal organisms of Korean Powdery (III). Report for the IBP (Korean National Committee) 6:39-45.
13. Lee, H. J. 1975. Unrecorded causal organisms of Korean Powdery (IV). Acad. Treat Hyosung Women's Coll. 16-17:439-449.
14. Lee, H. J. 1976. Unrecorded causal organisms of Korean Powdery (V). Nature & Life. Kyungpook. J. Biol. Scis. 6:89-95.
15. Park, J. S. 1958. Fungus disease of plants in Korea (I). Bull. Coll Agric. Chungnam Univ. I.
16. Park, J. S. 1961. Fungus disease of plants in Korea (II). Bull. Coll. Agric. Chungnam Univ. II.
17. Spaulding, P. 1961. Foreign diseases of forest trees of the world. USDA Agriculture Handbook No. 197.
18. Spencer, D. M. 1978. The powdery mildews. "History and Taxonomy of powdery mildews." Academic press, Inc. (London) Ltd. 1-37.
19. Yardwood, C. E. 1957. Powdery mildews. The Bot. Rev. 4:235-301.

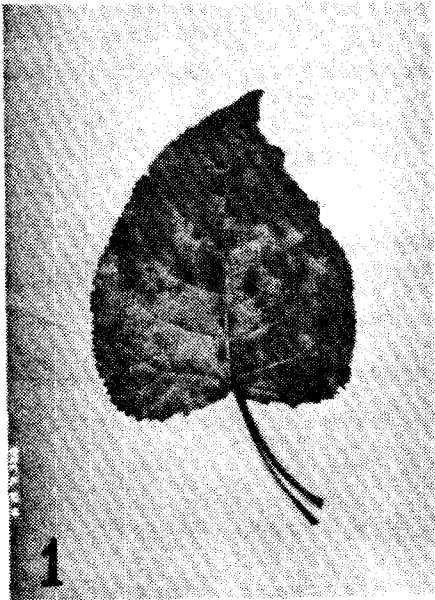


Fig. 1. *Phyllactinia guttata* on the lower surface of *Populus deltoides* R-89 leaf.

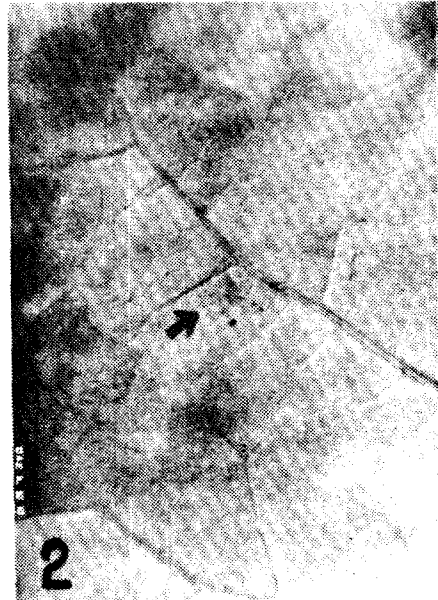


Fig. 2. Perithecia of *Phyllactinia guttata* on the lower surface of poplar leaf(arrow).

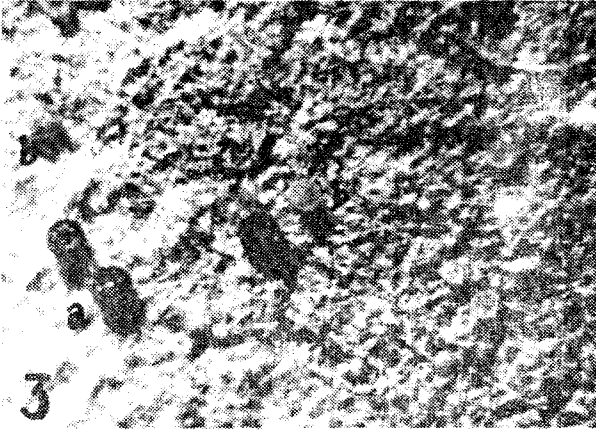


Fig. 3. Perithecia formed on powdery mildew white spots (x40).
a: mature perithecium
b: immature perithecium



Fig. 4. Mature perithecium with glossy appendages (x100). The appendages are located on the equatorial plane around the outside of perithecium (arrows).

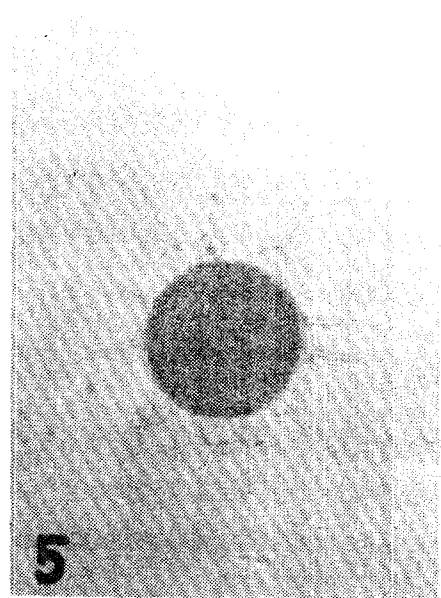


Fig. 5. Mature perithecium with bulbous-based appendages (x100).



Fig. 6. Enlargement of rigid, straight aseptate, hyaline, bulbous-based appendages (x280).



Fig. 7. Mature ascus with two ascospores (x400) (arrow)