



HOKKAIDO UNIVERSITY

Title	ホソキノデに寄生する銹菌 <i>Milesina vogesiaca</i> SYDOW とアヲトドマツ、モミ並にアカトドマツの針葉に生ずる其ペリダーミウム時代に就て
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NOTES ON MILESINA VOGESIACA SYDOW ON
POLYSTICHUM BRAUNII FÉE AND ITS PERI-
DERMIAL STAGE ON THE NEEDLES OF ABIES
MAYRIANA MIYABE ET KUDO, A. FIRMA SIEB. ET
ZUCC. AND A. SACHALINENSIS MAST.

BY

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(With 3 Text-figures)

ホソキノデに寄生する銹菌 *Milesina vogesiaca* SYDOW
とアヲトドマツ、モミ並にアカトドマツ
の針葉に生ずる其ペリダーミウム時代に就て

龜 井 專 次

Four out of the hitherto described seventeen species belonging to the genus *Milesina* parasitic on the fern-plant have been known to be genetically connected with the aecidiospores on *Abies*.

In 1916, KLEBAHN first proved experimentally the genetic relationship between the teleutospores of *Milesina Blechni* SYDOW on *Blechnum spicant* WITH. and the aecidiospores on *Abies pectinata* DC. and *A. cephalonica* LOUD. Since that time, these connections were also proved in *Milesina marginalis* FAULL et WATSON, *M. Kriegeriana* MAGN. and *M. polypodophila* (BELL) FAULL by FAULL, WATSON and MOSS (1926). In our country, only one species of the genus, *Milesina Scolopendrii* JAAP, was recorded by HIRATSUKA (1927), without any reference on its peridermial stage.

During the past few years the writer has been studying on the life-histories of many species of the Japanese fern-rust-fungi. The present paper was intended to report on the genetic relationship of one species of *Milesina* which was

newly identified of *Milesina vogesiaca* SYD. by the writer.

I. Identification of *Milesina* on *Polystichum Braunii* FÉE

In the vicinity of Sapporo, the writer often collected a rust-fungus on *Polystichum Braunii* FÉE (= *Aspidium Braunii* SPENNER). From the late summer to early winter, the uredosori of the fungus in question are produced abundantly on the under surface of the pinnae and sometimes even on the stipes. They are very minute, roundish and pale yellowish in colour, and the uredospores are formed in white filamentous or powdery masses. These sori are also seen on the overwintered fronds. The affected part is noticed first as a distinct yellowish speckle, and the spot extends gradually over the entire surface of the pinnae. The pseudoperidia of the uredosori are rather stout and the uredospores are oblong-ovoid, ovoid, ellipsoidal or sometimes angular in shape, and hyaline (Fig. 1). The episore looks as smooth when the spores were mounted in water, but the very minute warts on the wall are observable clearly in a dry state. In our specimens, especially those collected at Mt. Moiwa in the early winter, the writer found many teleutospores inside the epidermal cells of both surfaces of the discoloured pinnae. The teleutospores are mostly divided into two to five cells by the vertical septation and rarely one-celled (Fig. 2). After the careful review of the literature, the writer noticed that the fungus in question is the species, apparently identical to *Milesina vogesiaca* SYDOW parasitic on the pinnae of *Aspidium lobatum* Sw. in Germany. In the original description, SYDOW (1915) wrote that the uredospores of this species are smooth and the description of the teleutospores is incomplete because he failed to observe the fully matured ones. However, it is very interesting to note that the specimen of *Milesina vogesiaca*, which was distributed by SYDOW as No. 2345 of Exsiccati Uredineen, has the uredospores with very minutely verrucose wall which is clearly observable in a dry state as in our fungus. By the discovery of the fact, any difference could not be noticed between the uredostages of both fungi as shown in the following table. Moreover, the close affinity of the host plants, *Aspidium lobatum* Sw. and *Polystichum* {*Braunii* FÉE (= *Aspidium Braunii* SPENNER), places a great stress on the identity of both fungi,

although the comparison of the teleutospores is not capable by the incomplete description of German species. Finally, the writer came to the conclusion that the present fungus on *Polystichum Braunii* FÉE is the same species to *Milesina vogesiaca* SYDOW.

Table 1. Comparison of the fungus in question to *Milesina vogesiaca* SYDOW

	<i>Milesina vogesiaca</i> of Germany	Fungus in question
Uredosori	0.1–0.15 mm.	0.1–0.25 mm.
Pseudoperidial cells of uredosori	10–14 × 11–20 μ .	7.5–15 × 11–20.5 μ .
Uredospores	Ellipsoidal, ovoid or oblong, often angular; 15–22 × 20–40, rarely 50 μ .	Oblong-ovoid, ovoid, ellipsoidal or sometimes angular; 15–22.5 × 20–41, rarely 48 μ .
Teleutospores	Many celled, developed in the epidermal cells ¹	Mostly 2–5 celled, developed in the epidermal cells; 15–22 × 15–55.5 μ .
Host plant	<i>Aspidium lobatum</i> Sw.	<i>Polystichum Braunii</i> FÉE (= <i>Aspidium Braunii</i> SPENNER).

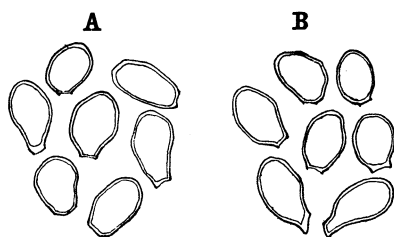


Fig. 1

Uredospores of *Milesina vogesiaca*
SYDOW ($\times 320$)

- A. on *Aspidium lobatum* Sw. (German specimen)
B. on *Polystichum Braunii* FÉE (Japanese specimen)

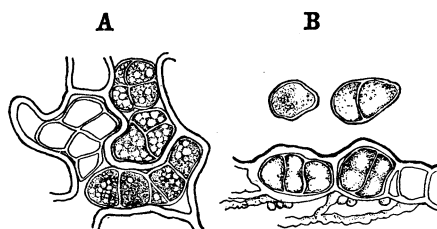


Fig. 2

Teleutospores of *Milesina vogesiaca*
SYDOW ($\times 320$)

- A. Upper view
B. Side view

II. Inoculation-experiments

A. *Experiments with the teleutospores.* As the inoculum, many, heavily affected pinnae of *Polystichum Braunii* FÉE were collected in the fall from a small valley about half way up of Mt. Moiwa near Sapporo and they were hanged on the shady outer wall of the laboratory, inclosing them in a cotton

bag. Just before the opening of fir-buds in the next spring several bits of the pinnae were taken out and placed in a Petri-dish which was beforehand lined with a moistened filter paper. Two or three days after, as soon as the basidia began to appear on the surface of the discoloured pinnae, the inoculation experiments were conducted. The basidia thus obtained are about $50 \times 7\mu$ in size and the basidiospores are about $8 \times 6\mu$. The inoculum was merely placed upon the needles of the potted fir-seedling which was sprayed thoroughly with water and covered with a bell glass. Two or three days after, the treated pot was transferred from the bell glass to a cool place and well watered every day. The inoculation-experiments were conducted repeatedly during five years, using some of three species of Japanese fir; *Abies Mayriana*, *A. firma* and *A. sachalinensis*, which were cultivated in the college nursery where any fear about the preinfection is sufficiently useless. The results of the experiments are shown in the following table.

Table 2. Results of the inoculation experiments with the sporidia of *Milesina vogesiaca* on *Polystichum Braunii* FÉE

Plants inoculated	Date of inoculation	Duration from inoculation to appearance of spermagonia (days)	Duration from inoculation to appearance of peridermia (days)	Remarks
<i>Abies Mayriana</i> IV ₄	May 21 1924	—	—	Experimented in a glass house
" " XIII ₄	June 4 "	20	28	"
" " XXII ₄	June 20 "	—	—	"
" " XVI ₅	June 6 1925	17	24	In outdoor
" " III ₆	June 7 1926	19	—	In a laboratory-room
" " XXI ₆	June 17 "	20	—	"
" " XXVI ₆	June 24 "	—	—	"
" " VIII ₈	May 30 1928	14	21	"
" " V ₉	June 4 1929	13	21	In outdoor
<i>A. sachalinensis</i> III ₅	June 7 1925	—	—	"
" " III ₆	June 6 1926	20	—	"

Plants inoculated	Date of inoculation	Duration from inoculation of appearance of spermagonia (days)	Duration from inoculation to appearance of peridermia (days)	Remarks
<i>A. sachalinensis</i> IV ₆	June 12 1926	—	—	In outdoor
<i>A. firma</i> III ₅	June 12 1925	—	—	"
" " I ₆	June 17 1926	14	27	In a laboratory-room

As shown in the above table, four seedlings of *Abies Mayriana* and one seedling of *Abies firma* were infected and produced both spermagonial and peridermal stages, while one of *Abies sachalinensis* and two of *Abies Mayriana* produced spermagonia only. An indication of the successful infection could be noticed in ten to fourteen days after inoculation by the production of the drops of honey-like juice from the spermagonia, scattered on the yellowish, discoloured spots of the needles. The peridermia appear usually at least three weeks after inoculation.

B. *Experiments with the aecidiospores.* To determine the return infection two experiments with the aecidiospores were conducted. In the first experiment, the inoculum was smeared directly on the under-surface of a pinna of a potted *Polystichum Braunii* FÉE with a sterile needle and the pot was covered with a bell glass. After a few days, the inoculated plant was transferred from the bell glass to a cool place. After seventeen days from the inoculation, several uredopustules were developed.

In the second experiment, the aecidiospores were transferred on a fresh pinna which was

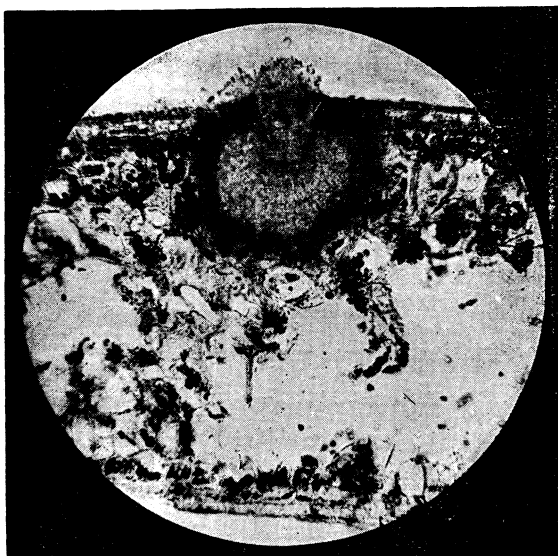


Fig. 3

Section of a spermagonium of *Milesina vogesiaca* SYDOW on the current year needle of *Abies firma*.
($\times 170$)

cut off from the host plant and laid on a moistened filter paper in a Petri-dish. After two weeks, the uredosori came out on the surface. Under the microscope, the writer proved that the uredospores gained in these experiments are the same to those collected in the field.

Table 3. Results of the inoculation experiments with the aecidiospores.

Inoculation material	Date of inoculation	Duration of appearance of uredosori (days)
Aecidiospores on <i>Abies Mayriana</i> XIII ₄	July 22 1924	17
" " on <i>Abies firma</i> I ₆	Aug. 27 1926	13

III. Description of the peridermial stage of *Milesina vogesiaca* SYDOW

Milesina vogesiaca SYDOW

Spermagonia amphigenous, mostly hypophyllous, inconspicuous, irregularly sparsed on yellowish discoloured spots, mostly on both sides of the midrib, at first honey-yellow, then reddish brown, subcuticular, immersed, in section depressed spherical to almost spherical, 122–177.5 μ in width, 111–163 μ in height; spermatophores simple, more or less straight, septate, obclavate; spermatia oblong, with rounded or truncate ends, smooth, hyaline, 5–7 $\times$ 1.5–2 μ .

Peridermia from a limited mycelium, hypophyllous, arranged in two rows, white, cylindrical, 0.25 mm. wide, 0.5 mm. high, ruptured at the apex, deeply seated; peridial wall colourless; cells mostly rhomboid or elongated hexagonal, overlapping, 14–22 $\times$ 26–33 μ , inner wall thick, coarsely verrucose, outer thin, smooth; aecidiospores globoid to ellipsoidal, 14–22.5 $\times$ 18–24 μ , mostly 18 $\times$ 21 μ , wall thin, 1.5–2.5 μ thick, verruculose, with hyaline contents, germ-pores inconspicuous.

On the current year needles of *Abies Mayriana* MIYABE et KUDO, *Abies firma* SIEB. et ZUCC. and *Abies sachalinensis* MAST. formed by the inoculation of the sporidia of *Milesina vogesiaca* SYDOW on *Polystichum Braunii* FÉE collected at Mt. Moiwa near Sapporo, Prov. Ishikari.

Finally, the writer wishes to express his sincere gratitude to Professor Emeritus Dr. K. MIYABE and Prof. S. ITO for their kind direction and to Prof. Y. TOCHINAI for his courtesy of reading the original draft of the manuscript. He is also indebted to Prof. Y. NIJIMA who has favoured him for the use of the seedlings cultivated in the college nursery.

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摘 要

羊齒植物に寄生する銹菌が其銹子腔時代をモミ屬の針葉に生じ、異株寄生生活をなす事は既に知らるゝ所なるも、ミレシナ屬に於ては KLEBAHN 氏が初めて *Milesina Blechni* SYDOW に就きて此關係を證明せる以來、今日迄只四種の菌につきて報告せられたるに止り、吾國に於ては未だ之れに關する何等の記事なし。

著者は北海道に自生するモミ屬の針葉に發生する、ペリターミウム並に之れが下草として生ぜる羊齒類に寄生する銹菌との關係に興味を感じ、之れが研究を爲しつゝある間に、ミレシナ屬の種類に就きて亦調査を爲し、聯か得る所ありたり。本報告は其一部にして *Milesina vogesiaca* SYDOW に關する種類鑑定、生活史並にペリターミウム時代の性質に於て、新たに知り得たる所を記述せるものなり。

札幌附近に産するホソキノデ (*Polystichum Braunii* FÉE) に發生する銹菌は、其夏孢子時代諸性質の酷似 (第一表参照) 並に寄主植物の近縁なることに由りて、獨逸 HOHNECK にて *Aspidium lobatum* SW. に寄生せる前記の種類と同一なりと決定せり。同菌に關し SYDOW 氏は其夏孢子の膜が恰かも、ウレテイノブシス屬の種類の如く平滑に見ゆること並に完全なる冬孢子を観察し得られざりしを報ぜり。本邦産ホソキノデの場合にありては、冬孢子は寄主植物の表皮細胞内によく發達し、其夏孢子の膜は乾ける儘に檢鏡する時には一面に極く微細なる疣狀突起を有せり。但し SYDOW 氏の配布せる標本壺中の本菌に於ても同様なる疣狀突起を有するを認め、益々彼我同一菌たるを確かめ得たり。次に冬孢子の發芽によりて生ずる小生子の接種試験を爲し、生活史の追究を試みたるにアサトドマツ、モミ、アカトドマツの一年目の針葉に各々ペリターミウム時代を生じ、又此試験に由りて得たる銹孢子を逆にホソキノデの羽片に接種するときは、野外に生ずるものと同一の夏孢子を生じたるが故に、茲に明かに本種の生活史を闡明することを得たり。尙ほ第一圖 A はホソキノデに生ぜる夏孢子、B は獨逸産標本の夏孢子、第二圖 A は冬孢子を寄主植物の表皮を透して上より見たる圖、B は其斷面圖、第三圖はモミ I_0 の一針葉に生ぜる一雄精器の斷面圖なりとす。