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Author(s)	亀井, 専次
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NOTES ON THE CULTURAL STUDY OF A NEW SPECIES OF HYALOPSORA

BY

SENJI KAMEI

(With 3 Text-figures)

Hyalopsora Aspidiotus MAGN. is the only species in the genus that has ever been proved to be heteroecious between *Abies* and fern. Comparing with the most species of white-spored rusts of *Abies*, this species is rather complicated in the process of its life-cycle. With the teleutosporic material BUBÁK (2), KLEBAHN (3, 4) and MAYOR (5) have already engaged in the inoculation experiments. According to the results of works done by MAYOR who was successful in the proof of the entire life-cycle, the sporidia gained from a fern host infected young needles of *Abies pectinata* DC. producing spermogonia in the next spring and aecidia in the following next spring requiring 4 years for the completion of the whole life-history. BELL (1) on the other hand, found in Timagami Forest, Ontario, Canada, a new species of the *Peridermium* on the three-year-old needles of *Abies balsamea* (L.) MILL. to which he named as *Peridermium pycnoconspicuum* BELL. He inoculated with the aecidiospores thus obtained onto the frond of *Phegopteris Dryopteris* FÉE and succeeded in producing the characteristic uredospores of *Hyalopsora Aspidiotus* MAGN. So the peridermial stage of this species is at present proved to be parasitic on two species of *Abies* both American and European.

While continuing the life-history studies of the fern-rusts of our country the writer happened to find an interesting new species of *Hyalopsora* parasitic on *Blechnum Spicant* WITHER. var. *nipponicum* (KUNZE) MIYABE et KUDO. This fern is found common in the vicinity of Sapporo, for instance, in the Nopporo Forest about 10 miles east from our city, where the primeval forest vegetation is still preserved. It grows luxuriantly by the way side or underneath the bushes composed of numerous small trees of *Abies Mayriana* MIYABE et KUDO and various species of deciduous trees. In the early summer, especially on the overwintered fronds we find abundant conspicuous uredosori. The pustules are mostly restricted on the upper surface, and are easily attracted by the powdery,

golden-colored mass of uredospores pushing out from each sorus (Fig. 1). These spores are thin-walled, sparsely but strongly echinulated, very char-

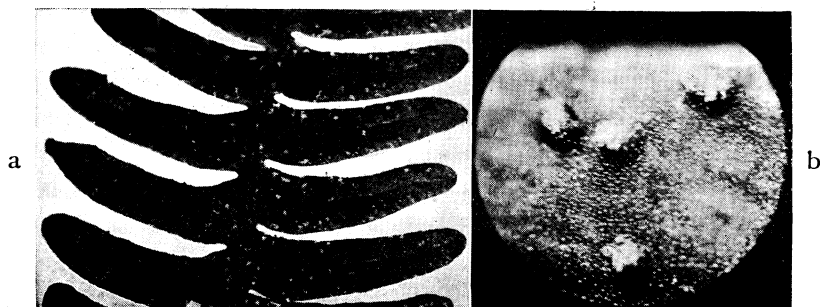


Fig. 1

Uredosori of *Hyalopsora aculeata* n. sp. on the overwintered frond of *Blechnum Spicant* W. var. *nipponicum* (K.) M. et. K. collected at Nopporo, on June 15 1931 a, $\times 1$; b, $\times 10$

acteristic compared with those of the other species (Fig. 2, b). The pseudo-peridia are stoutly developed, which are dehiscient by apical rupture (Fig. 1. b). The thick walled uredospores, which are commonly found in the case of the other related species, are not found in this species. Teleutospores are produced inside the lower epidermal cells of overwintered fronds (Fig. 2, d). These portions are slightly discolored when the spores are matured. From the beginning to the middle of June, after the spores begin to germinate, the under-surface of the frond is covered by light grayish to whitish colored films except two longitudinal sterile portions. These films when seen under the microscope reveal to be the aggregation of abundant sporidia and basidia, which have emerged through the minute holes penetrated on the upper wall of the epidermis (Fig. 2, d). With those sporidia inoculation experiments were repeatedly conducted on the young seedlings of *Abies Mayriana* M. et K. Out of 7 pots, 4 (XIII₆, XIV₆, VII₇, and XXVII₁₁) have shown spermogonia on the needles of current season about 20 to 28 days after inoculations. These spermogonia a few in number, 5 to 15 per leaf, mostly on two stomatiferous surfaces, are slightly raised on the surface and are almost elliptic in upper view (Fig. 3, a). In sections they are subepidermal and flattened conoidal to lense form (Fig. 3, b, d). Comparing with the size of those in *Peridermium pycnoconspicuum* B. which was given by BELL, the spermogonia in our case are longer in the vertical direction, though almost nearly equal in breadth. The

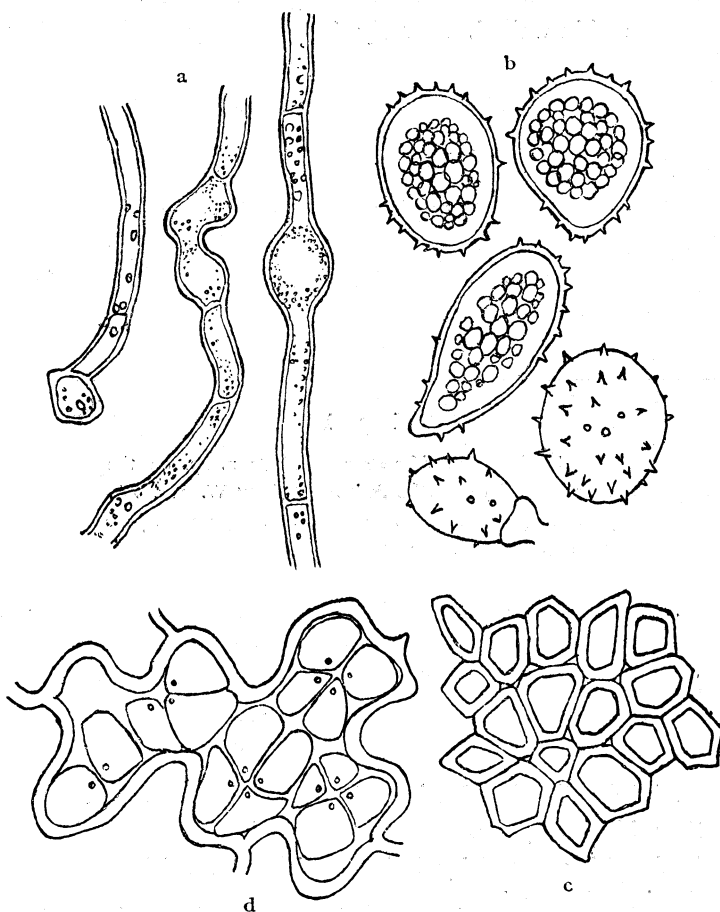


Fig. 2

Hyphae (a), uredospores (b), middle part of pseudoperidium of a uredosorus (c) and teleutospores (d) of *Hyalopsora aculeata* n. sp. $\times 480$

peridermia on the contrary, did not well develop in every pot experimented. In one affected leaf of the current season in pot XIII₆, however, an imperfectly grown peridermium sorus was observed, just beside a matured spermogonium. It was already differentiated into the pseudoperidium and the orange colored aecidiospores (Fig. 3, c). Beside this case the writer did not find any trace of peridermium sorus in spite of his careful observation on the inoculated seedlings throughout the season. Considering from the process of the life-cycle

this species is not similar to *Hyalopsora Aspidiotus* MAGN. But the question, whether the peridermial sori habitually mature on the needles of the current

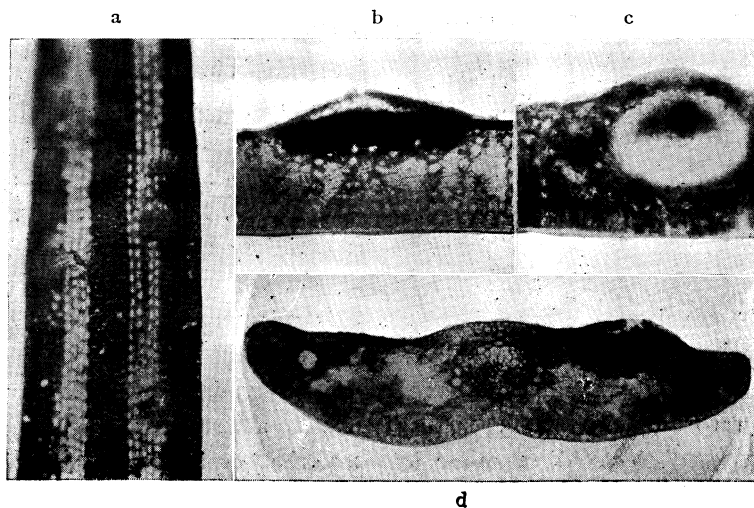


Fig. 3

Spermogonia and a peridermium of *Hyalopsora aculeata* n. sp. gained from cultural experiments. a. Face view of mature spermogonia on a 1-year-old leaf of *Abies Mayriana* M. et K. $\times 7$; b, c. Median vertical sections of spermogonia (b, from longitudinal section; d, from transversal section of leaf) $\times 52$; c, Median vertical section of an immature peridermium (from longitudinal section of leaf) $\times 52$

season or otherwise behave, is remained for the further investigation to prove. Now, though not proved by the back inoculations, the constant appearance of the spermogonia through 4 pots and a case of the imperfect peridermium sorus producing the aecidiospores of colored contents common to the species of *Hyalopsora* made the writer to convince him that these stages on *Abies Mayriana* M. et K. are connected to the present rust species on *Blechnum*. The characters of uredo and teleuto stages are different from those of the related species, especially in the greater size, and stronger echinulations of the uredospores and in the stout pseudoperidia. So the writer wishes to admit it as a new species and to call it by the name of *Hyalopsora aculeata*. According to Professor HIRATSUKA of the Tottori Agricultural College this species is also found parasitic on *Blechnum amabile* MAKINO which is distributed in the higher mountains of Honshû. Though the writer is not yet seen the specimen but the occurrence is highly probable because the two host plants are so closely related that one can hardly

discriminate when two are grown together. The diagnosis of the new species is as follows:—

***Hyalopsora aculeata* KAMEI, nov. sp.**

O. Spermogoniis hypophyllis, maculis dilute flavidis insidentibus, in duas series utrimque ad nervum dispositis, inconspicuis, secto folio conspicuis, subepidermicis, subconoideis vel lenticularibus, magnis, 300–500 μ longis, 100–200 μ latis; Spermatophoris obclavatis, 30–50 μ longis, 3–5 μ latis, hyalinis; spermatiis oblongo-ellipsoideis, 6.5–8.0 μ longis, 3.2–3.6 μ latis, levibus. hyalinis.

I. Aecidiis imperfectis; peridio exstanti; aecidiosporis flavo-brunneis.

II. Soris uredosporiferis plerumque epiphyllis, sparsis vel aggregatis, saepius ad marginem vel nervum dispositis, rotundatis, minutis, 0.3–0.7 mm. diam., flavis vel brunneis, apice apertis et pulverulentis; peridio firmo, in parte superiori cellulis polygonalibus composito; uredosporis obovatis, ovato-oblongis vel subglobosis, raro angulatis, 20–34 $\times$ 30–48 μ , intus aurantiacis; episporio hyalino, 1–2 μ crasso, distincte disperse aculeato; poris germinationis obscuris; paraphysibus paucis.

III. Teleutosporis plerumque hypophyllis, in maculis dilute brunneis insidentibus, intracellularibus, globosis vel ellipsoideis, plerumque 1–5 cellulis, hyalinis, 16.5–29.5 $\times$ 29.5–52 μ ; episporio ca. 1 μ crasso, levi; sporidiis subglobosis, ca. 10 μ dimetientibus, hyalinis, levibus.

Hab. O and I on *Abies Mayriana* MIYABE et KUDO. Mature spermogonia and imperfectly developed peridermium on the current year needles formed by the inoculation of sporidia obtained by the germination of the new species concerned. II on the overwintered fronds as well as on those of the current season appearing from June to November, III on the overwintered fronds of *Blechnum Spicant* WITHER. var. *nipponicum* (KUNZE) MIYABE et KUDO collected at Nopporo, Prov. Ishikari in June.

In conclusion, the writer wishes to express his heartiest thanks to Prof. Emerit. KINGO MIYABE and Prof. SEIYA ITO for their kind directions and Prof. NAOHIDE HIRATSUKA for his kind advice.

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Phytopathological laboratory, Faculty of Agriculture,
Hokkaido Imperial University, Sapporo

摘 要

ヒアロブソラ属一新種の生活史に関する研究報告

重 井 専 次

羊齒類に寄生する銹菌中ヒアロブソラ属の種類にして、今日迄に其異株寄生性に關し實驗的に證明されたるものは單に *Hyalopsora Aspidiotus* MAGN. のみなり。乃ち之れに就ては早くより BUBÁK, KLEBAHN 等の報告あるも、完全なる解決をなしたるは佛國の MAYOR なり。同氏に據れば本菌の成熟冬孢子より得たる小生子は歐洲樺の嫩葉に侵入し、翌春に至りて雄精器を生じ、翌々春に至りて銹子腔を生じ斯くて足掛四年にして其生活史を完了するなりと云ふ。又加奈太國 BELL はオンタリオ地方チマガミ森林内バルサム樺の三年目の針葉に生ずる獨特なるベリダーミウムを採集並に命名し、其銹孢子を以て接種試験を果せる後氏は上菌の一時代なる事を公表せり。由りて上菌は歐米二種の樺屬種類に關係を有し、長期に亘る生活徑路を辿る事明かなれり。著者は年來、野幌國有林内アトドマツ林下に生ずるシシガシラに寄生するヒアロブソラ属の一種に興味を引かれ、其冬孢子を發芽せしめて得たる小生子をアトドマツ幼苗嫩葉に接種すること數回に及びしが、被接種根苗合計七本中四本は接種後二十日乃至二十八日にして嫩葉裏面に雄精器を發生したるも、銹子腔は只一回成熟雄精器に近接して未だ十分發達せざるものを見たるのみなり。但し之にありては已に擬護膜を生じ、且つ其銹孢子はヒアロブソラ属に通有なる橙黄色の内容を有せり。而して斯かるベリダーミウムを BELL 記載のものに比較するに、其雄精器はやゝ大形にして又其發生針葉の年數が同一ならざるを見る。著者は未だ銹孢子による接種試験を行ひ得ざるも、上記の小生子接種試験に於て供試苗四本迄孰れも雄精器を見たる事、並びに假令一回なるも銹子腔を得而も鮮明なる着色あることを確かめたる以上、之をシシガシラ寄生銹菌の一時代なりと認むべき十分の理由ありと信ず。尙ほ之が夏孢子、冬孢子時代の性質を近縁諸種と比較するとき夏孢子層擬護膜の強壯なること、夏孢子の大形なること、其膜面に強き刺狀突起を有する點等に於て明かに異なるものにして、茲に之を新種と認め其種名及記載文を公表せり。尙ほ平塚直秀氏に據れば本種はシシガシラの他に本州地方の深山に産するオサシダにも寄生する由なるが、著者は未だ標本を鏡見せざるも其寄主植物が甚だ近縁なる事實より恐らく然るべきことを憶測する次第なり。終りに臨み終始懇篤なる御指導を賜はれる宮部名譽教授、伊藤教授並に有益なる助言を垂れられし平塚直秀氏に對し深謝の意を表す。