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ON MILESINA ITOANA, SP. NOV. AND ITS PERIDERMIAL STAGE

BY

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(With Plate I)

Abies Mayriana MIYABE et KUDO and *Abies sachalinensis* FR. SCHMIDT and *Dryopteris crassirhizoma* NAKAI are commonly associated in the primeval forests in various parts of Hokkaido. From about the middle of September to the beginning of December, current year needles of these species of Abies are frequently seen to be attacked by a certain characteristic white Peridermium causing considerable damage to the vigor of the hosts not only in the mature trees but also in small seedlings on the floor of the forests.

The spermogonia accompanying peridermia are constantly matured underneath the epidermis (Pl. I, fig. e). They are very large appearing almost spherical, while the peridermial cups are rather stout and erumpent frequently splitting the tissues of the undersurface of the affected leaves (Pl. I, fig. a). From the apparently similar features of the spermogonia the writer has long been inclined to consider it to be the aecidial stage of *Milesina Miyabei* KAMEI which has proved to be parasitic on the same host plants above mentioned and is commonly found in the vicinity of Sapporo. Close comparison of the aecidial stage of the two rusts, however, indicates that in the case of the rust under consideration the inner cell wall of the peridial cells are thicker and the papillae on its surface appear as densely studded ridge-like markings in face view (Pl. I, fig. f), whereas in the case of *Milesina Miyabei* KAMEI the cell walls are thinner and adorned with shorter papillae which appear as verruculose tubercles. Also the aecidiospores are consistently larger. Tentatively performed inoculation experiments with the aecidiospores collected from the fields made inside of a moist chamber on the fronds of *Dryopteris crassirhizoma* NAKAI have resulted in the production of uredosori (Pl. I, fig. b) and sometimes also teleutospores that are quite different from those of *Milesina Miyabei* KAMEI especially in the former organ. However, uredospore specimens collected from the field have hitherto been lacking in our herbarium in spite of the writer's repeated

[Trans. Sapporo Nat. Hist. Soc., Vol. XIV, Pt. 2, 1935]

attempts to find this form mingled among other two rusts, namely, *Milesina Miyabei* KAMEI and *Milesina carpatica* WROBLEWSKI[1] which are also parasitic on the same host fern. So there was some hesitation in determining that the spores resulting from the inoculations are really related to the peridermia used for inoculation material. Nevertheless, according to FAULL[2] the uredostage of *Milesia intermedia* FAULL on the east coast of North America was not easily collected on the current year's fronds of host ferns but secured from the overwintered leaves. This suggested the probable existence of a similar condition in our locality in connection with the rust form in question. On April 5 of this year visiting the Nopporo Forest, in a certain restricted small area, where about 20-years old trees of *Abies Mayriana* MIYABE et KUDO which were seen heavily attacked by the Peridermium in the previous autumn (Pl. I, fig. d) are abundantly standing, the writer was able to collect several specimens of uredospore (Pl. I, fig. c) as well as teleutospore materials on overwintered fronds that are quite similar to those from the inoculation tests above mentioned. A little later, another materials of affected overwintered fern were received from the University Experimental Forest at Tomakomai, Prov. Iburi. With the teleutosporic materials of this form from Nopporo and Tomakomai inoculation experiments with sporidia were performed on July 4–20 of this summer on current year needles of 3 young seedlings of *Abies Mayriana* MIYABE et KUDO taken from the nursery bed. Discolorations of the needles to a greater or less degree were seen after about 16 days, and the spermogonia were matured after 22–33 days. The aecidia were seen to be erumpent on the surface of the needles of each of the 3 pots on Oct. 1 after 101–117 days having elapsed since the inoculations. These specimens of the peridermial stage were quite the same as those collected in the field at Nopporo and other localities. Back inoculations with the aecidiospores experimentally produced were made on Oct. 4 on the fronds of *Dryopteris crassirhizoma* NAKAI in moist chambers, and the resulting uredospores were issued on Nov. 12–16 after a lapse of 40 to 44 days. The incubation periods needed for the production of the aecidiospores as well as the uredospores are far longer than those in the case of *Milesina Miyabei* KAMEI.

The shape of the uredospores of this rust is rather similar to that of *Milesia fructuosa* FAULL (synonymous to *Milesia intermedia* FAULL according

(1) Previously (Trans. Sapporo Nat. Hist. Soc. XII, Pt. 2 & 3, 171, 1932) the writer tentatively refered to this rust as *Milesina Kriegeriana* MAGN., from which it differs mainly in the size and markings of the uredospores.

(2) FAULL, J. H.: The Biology of Milesian Rusts, Journ. of the Arnold Arboretum, Vol. XV, 50–80, 1934.

to FAULL's latest opinion) on *Dryopteris spinulosa* (MÜLLER) SW. var. *fructuosa* GILBERT) TRUDELL, but the markings on the epispores are more inconspicuous apparently smooth in wet mounts. Moreover, the morphology of the spermogonia and aecidia as well as the incubation period on Abies are quite different from those characters of the American species. From *Milesina exigua* FAULL whose morphology of uredospores is rather similar, it distinctly differs in respect to the size and development of uredosori. The same holds true as well in comparison with the morphology of spermogonia and aecidia on Abies.

According to the author's experience, the peridermial stage of this rust is the most common one causing most severe damage to fir trees among some fifteen species of related white rusts that proved to be parasitic on one and the same host, namely, *Abies Mayriana* MIYABE et KUDO in our locality.

The specific name is given in honor of Professor SEIYA ITO who collected the present rust on *Abies Mayriana* MIYABE et KUDO at Maruyama near Sapporo on Nov. 23, 1912 and made excellent illustrations of affected needles, peridial cells and aecidiospores. In conclusion, the writer wishes to tender his heartiest thanks for the kind directions received from Emeritus Professor KINGO MIYABE and Professor SEIYA ITO.

The diagnosis of this rust is as follows:

Milesina Itoana KAMEI, sp. nov.

Spermogoniis hypophyllis, abundantibus, inconspicuis, hyalinis, fere sphaericis, subepidermicis, 160-352 μ latis, 110-290 μ altis, plus minusve 260 × 200 μ; spermatiis oblongo-cylindricis, 5-6 μ longis, 1-1.5 μ latis, hyalinis. Aecidiis amphigenis, praecipue hypophyllis, maculis plus minusve flavidis insidentibus, secus series duas dispositis, cylindricis vel parum lateraliter compressis, 0.2-0.5 mm. diam., 0.2-2.0 mm. altis, albis, ad apicem dehiscentibus; cellulis peridii subimbricatim positis, polygonalibus, 21-42 μ longis, 12-30 μ latis, plus minusve 26 × 18 μ, parietibus exterioribus levibus, ca. 1 μ crassis, interioribus 4-7 μ crassis, dense rugosis. Aecidiosporis globosis, ovatis vel ellipsoideis, dense subtiliterque verrucosis, hyalinis, 20-38 × 14-29 μ, plus minusve 25 × 20 μ; episporio 1.0-1.5 μ crasso. Soris uredosporiferis minutis, hypophyllis, epidermide tectis, in areis discoloribus, saepius ad marginem foliorum sparsis, immersis vel leviter pustulatis, rotundatis, 0.06-0.17 mm. diam., cellulis peridii hyalinis, irregulariter polygonalibus, non imbricatis, 4-16 μ diam., parietibus 1 μ vel minus crassis. Uredosporis obovatis vel oblongis, levibus, hyalinis, 24-46 × 14-26 μ, plus minusve 30 × 18 μ, episporio 0.5-0.7 μ crasso. Teleutosporis intra cellulas epidermidis evolutis, amphigenis, praecipue hypophyllis, verticaliter septatis, pluricellularibus, levibus, hyalinis; cellulis teleutosporarum 12-16 × 7-14 μ.

Hab. in foliis *Abietis Mayrianae* et *Abietis sachalinensis* et *Dryopteridis crassirhizomae* in prov. Ishikari, Iburi, Kushiro et Kitami in Japonia.

The specimens examined are as follows:

O and I on current year needles of *Abies Mayriana* MIYABE et KUDO (Aotodomatsu). Hokkaido: Prov. Ishikari: Nopporo Forest; Oct. 26 1925 (m), Oct. 31 1926 (m), Oct. 28 1931 (m), Nov. 23 1931 (m), Oct. 15 1933 (m), Nov. 19 1933 (m), Oct. 5 1934 (m), Oct. 8 1934 (m), Mt. Moiwa; Oct. 19 1933 (m), Sapporo; Cult. I 283, 284, 285, (m), Prov. Iburi: Tomakomai Royal Forest; Sept 29 1932 (m), Nov. 2 1933 (m), Tomakomai University Forest; Nov. 1 1933 (m), Lake Shikotsu; Nov. 2 1933 (m), Mt. Eniwa; Sept. 15 1934 (m).

O and I on current year needles of *Abies sachalinensis* FR. SCHM. (Akatodomatsu). Hokkaido: Prov. Kushiro: Mt. Meakan; Sept. 14 1933 (m), Prov. Kitami: Oketo National Forest; Sept. 20 1933 (m).

II and III on fronds of *Dryopteris crassirhizoma* NAKAI (Yezomemma). Hokkaido: Prov. Ishikari: Nopporo Forest; April 5 1935 (II, III) (m), Type !!, May 12 1935 (II, III) (m), Sapporo; Cult. IV Nos. 14, 16 b, 27, 29 vi, 29 vii, 32, 34, 35 A', 36 Aa, 36 Ab, 37 a, 37b, 38 a, 38 b, 38 c, 38 d, 38 f, 38 g, 38 h, 38 i, 38 j, 38 k, 38 l, 38 m, 38 n. 38 o, 38 q (II). 40 i a (II, III), 40 i d, 40 i e, 40 i f, 40 ii Aa, 40 ii Bb, 40 ii Bg, 49 A i ba′, 49 A ii ba′, 49 A ii bb′, 49 A iii bb′, 49 A iii ba′, 49 Bi ba′, 49 Bi bb′, 49 Bii bb′, 49 Ci bl′, 49 C ii bb′, 49 C ii bc′, 49 C iii b, 49 C iii a′, 49 C iv ba′, 49 C iv bc′, 51 (II) (m), Prov. Iburi: Tomakomai University Forest, July 15 1935, Sigeji Ito (II, III).

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Explanation of Plate

Milesina Itoana sp. nov.

Fig. a. Peridermia and spermogonia on an affected needle of *Abies Mayriana* M. et K. collected at Tomakomai Royal Forest 301, on Sept. 28 1932 by SENJI KAMEI. × 17.

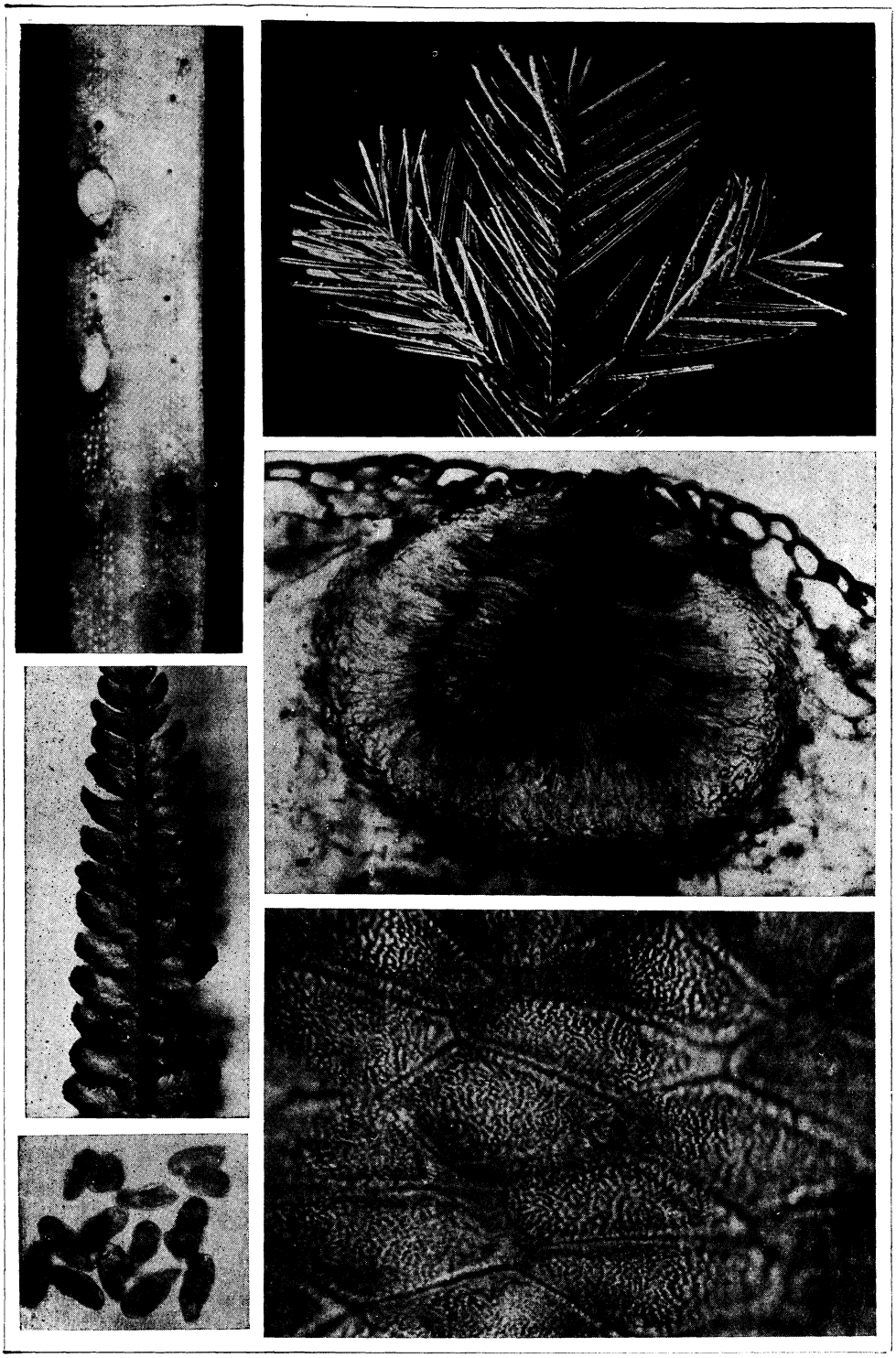
Fig. b. Uredospore-masses on an inoculated pinna of *Dryopteris crassirhizoma* NAK. resulted from aecidiospore inoculation experiment No. 38. Inocula collected at Lake Shikotsu on Nov. 2 1933 by SENJI KAMEI. Uredospores issued after 27 days on Dec. 4 1933. × 1.

Fig. c. Uredospores of the type specimen, collected at Nopporo Forest on April 5 1935 by SENJI KAMEI. × 310.

Fig. d. Affected shoots of an about 20–years old tree of *Abies Mayriana* M. et K. collected at Nopporo Forest on Oct. 8 1934 by SENJI KAMEI. Slightly reduced.

Fig. e. A spermogonium in the transversal section of an affected needle of *Abies Mayriana*, same as Fig. a. × 310.

Fig. f. Face view of inner surface of peridial cells of a peridermium, same as Fig. d. ×900.



S. KAMEI photo.