HOKKAIDO UNIVERSITY

Title	菊科植物に寄生する二種の「コレヲスポリウム」に就きて
Author(s)	平塚, 直秀
Citation	札幌博物学会会報, 9(2), 217-224
Issue Date	1927-10-15
Doc URL	https://hdl.handle.net/2115/63131
Type	journal article
File Information	Vol.9No.2_003.pdf

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ON TWO SPECIES OF COLEOSPORIUM PARASITIC ON THE JAPANESE COMPOSITÆ.

BY

NAOHIDE HIRATSUKA.

菊科植物に寄生する二種の『コレヲスポリウム』に就きて

平　塚　直　秀

Up to the present time, about forty species of *Coleosporium* parasitic on *Compositae* have been described by many mycologists. Among them, about ten species have been recorded from our country.

In 1910, ORISHIMO[1] studied the life cycle of *Coleosporium Asterum* (DIET.) SYD. and proved successfully its genetic relation. No other Japanese species of the genus have yet been studied on this line by any one up to the present. Fortunately, the writer has collected *Coleosporium Eupatorii* ARTH. and *C. Saussureae* THÜM. in a quite sufficient quantity for the inoculation-tests and proved their genetic connections. The present short paper is intended to report the results briefly.

The writer wishes to express his heartiest thanks to Profs. K. MIYABE and S. ITÔ for their kind help and constant encouragement.

I. Coleosporium Eupatorii ARTHUR

In 1906, ARTHUR[2] described a *Coleosporium* on *Eupatorium macrophyllum* L. collected in Cuba by E. W. D. HOLWAY in 1903, as *Coleosporium Eupatorii* ARTH. Afterwards, he[3,4] added two species of *Eupatorium*, *Eupatorium collinum* DC. and *E. Oestideanum* BENTH. to the host plants of this species in North America.

1) Bot. Mag. Tokyo, XXIV, p. 1 (1910).
2) Bull. Torr. Bot. Club, XXXIII, p. 31 (1906).
3) North American Flora VII, p. 90 (1907).
4) *Ibid.* VII, p. 654 (1924).

[Trans. of Sapporo Natural History Soc. Vol. IX, Part 2, 1927.]

In 1913, MAYOR[1] recorded this species on *Eupatorium macrophyllum* L. collected in Columbia. But, these specimens have the uredostage only.

In 1905, DIETEL[2] described a rust fungus on *Eupatorium japonicum* THUNB. collected by S. KUSANO in Nikkô as *Coleosporium Senecionis* (PERS.). In 1908, MIURA[3] described a fungus on *Eupatorium sachalinense* MAK. (he misidentified this host plant as *Eupatorium japonicum* THUNB.) collected by G. YAMADA at Maruyama near Sapporo in October, 1896 and Yuni, prov. Ishikari in September, 1899, as a new species, *Coleosporium Yamadai* MIURA in his graduation thesis. But his paper has not yet been published in any form. FUJIKURO[4] identified a rust fungus parasitic on *Eupatorium chinensis* L. var. *tripartitum* MYC. collected in Formosa with *Coleosporium Eupatorii* ARTH.

In 1923 to 1926, the writer collected plenty of *Coleosporium* on *Eupatorium japonicum* or *E. sachalinense* at several places in Hokkaidô and Sukayu, prov. Mutsu, Honshû. After a careful examination, the writer found the fungi on *Eupatorium japonicum* and *E. sachalinense* collected by him to be exactly identical with *Coleosporium Eupatorii* ARTH. and MIURA's *Coleosporium Yamadai*. In the summer of 1923, the writer observed that many individuals of *Eupatorium sachalinense* had been severly attacked by the fungi in a plantation-forest of *Pinus koraiensis* SIEB. et ZUCC. at the foot of Mt. Moiwa near Sapporo. In the early spring of the next year, the writer fortunately discovered the appearance of spermogonia of *Coleosporium*-type on two year old needles of *Pinus koraiensis* at the same locality. Then, in May the same year, he found formation of the *Peridermium*-type aecidia on the same leaves. When the writer examined this fungus, the idea at once arose in his mind that this *Peridermium*-type aecidia might be a stage of *Coleosporium Eupatorii* ARTH. on *Eupatorium sachalinense* which had been collected at the same place in the summer of the previous year. So the writer collected *Peridermium* on *Pinus koraiensis* for the inoculation experiment on May 19. A spore suspension of the aecidiospores was made from the fresh sori taken from the leaves of the Korean pine and sprayed in

1) Mém. Soc. Neuchâtel. Sc. nat. V, p. 552 (1913).

2) Engl. bot. Jahrb. XXXIV, p. 107 (1905).

3) Contribution to the knowledge of the Uredinales parasitic on the Compositae of Japan (Graduation thesis of College of Agriculture, Tôhoku Imperial University, 1908).

4) Transact. Formosa Nat. Hist. Soc. XIX, p. 9 (1914).

the laboratory by means of an atomizer on the leaves of *Eupatorium sachalinense* which were transplanted from the southern side of Mt. Moiwa about 7 kilometers distant from the plantation of the Korean pines. The inoculated plants in pots were then covered with bell jars and placed in a room where the temperature ranged between 9° and 16°C. After two days, the bell jars were removed and the plants kept well watered. After 9 days (May 26), uredosori began to appear here and there on the leaves of *Eupatorium sachalinense*, while none of the control plants showed any signs of the appearance of uredosori. About two weeks after inoculation, numerous uredosori covered the inoculated leaves, and after three weeks or more the teleutosori appeared on the same leaves.

II. Coleosporium Saussureæ THÜMEN

In 1880, THÜMEN[1] collected the uredostage of a *Coleosporium* on an undetermined species of *Saussurea* in Siberia and named it *Coleosporium Saussureae* THÜM. Then, in 1905, DIETEL[2] described a new species, *Coleosporium Saussureae* DIET. on *Saussurea japonica* DC. collected in prov. Tosa by T. YOSHINAGA, and he[3] also identified the fungi on *Saussurea Maximowiczii* HERD. at Nikkô and *S. ussuriensis* MAXIM. on Mt. Takao collected by S. KUSANO as the same species. MIURA[4] says in his graduation thesis that DIETEL's species is distinguished from that of THÜMEN (the differences between them were not discussed in it), and the former can not be called *Coleosporium Saussureae* DIET. by the rule of nomenclature, so he adapted a new name, *Coleosporium japonicum* MIURA by him.

In 1914, TRANZSCHEL[5] reported in his paper, *Coleosporium Saussureae* THÜM. on *Saussurea Tilesii* LEDEB. collected in Kamchatka. P. & H. SYDOW[6] in their monograph, described Japanese species, *Coleosporium Saussureae* DIET. as a synonym of *Coleosporium Saussureae* THÜM. in 1915.

The writer examined many specimens of *Coleosporium* parasitic on several species of *Saussurea* which were preserved in the Herbarium of Hokkaidô Im-

1) Bull. Soc. Impér. Nat. Moscou, LV, p. 212 (1880).
2) Engl. bot. Jahrb. XXXIV, p. 588 (1905).
3) *Ibid.* XXXVII, p. 107 (1905).
4) l. c.
5) Die Pilze und Myxomyceten Kamtschatka's, p. 552 (1915).
6) Monographia Uredinearum III, p. 614 (1915).

perial University and those of his own collections, and he found five species of *Saussurea* from our country affected by *Coleosporium*; they are *Saussurea japonica* DC., *S. Maximowiczii* HERD., *S. Riederi* HERD., *S. Tanakae* FR. et SAV. and *S. ussuriensis* MAXIM. in which are included the DIETEL's type specimens. After a careful examination, he could not find microscopically any remarkable morphorogical difference between these fungi on the different species of *Saussurea*. For the present, it is advisable to include these fungi under one species, *Coleosporium Saussureae* THÜM. as is SYDOW's opinion. Among the above species of *Saussurea*, two species, *Saussurea Tanakae* and *S. Riederi* are new host plants to the present fungus.

On August 3, 1925, the writer climbed Mt. Kuro-dake, a eastern peak of the Taisetsu-range from Sôunbetsu, and spent several days in the shed near the top for study of the mycological flora of the Taisetsu-range. During our excursion, the writer collected many samples of *Coleosporium Saussureae* THÜM. on *Saussurea Riederi* HERD. on the eastern slope of the alpine meadow near the summit of Mt. Kuro-dake and also discovered many old *Peridermium*, the aecidiospores of which were already gone away, on two year old needles of *Pinus pumila* REGEL. in the same locality. So he considered that the aecidial stage of *Coleosporium* on *Saussurea Riederi* may occur on the leaves of *Pinus pumila*.

On August 17, the same year, Prof. K. MIYABE, Mr. M. TATEWAKI and the writer also visited the same place and could confirm that the same conditions were present at that time.

The third visit was made under the direction of Prof. S. ITÔ by the writer with other gentlmen in the laboratory on July 26, 1926. At this time, a large number of well-matured *Peridermium* on two year old needles of *Pinus pumila* were collected by ourselves at the same place. After our return to Sapporo, under suggestion of Prof. ITÔ, the writer on August 3, 1926, inoculated these aecidiospores of *Peridermium* from Mt. Kuro-dake, on the leaves of *Saussurea Riederi* which Mr. B. ISHIDA, Assistant in the Botanical Garden to the University, collected on Mt. Asahi-dake, one of peaks of the Taisetsu-range, several years ago and has cultivated in the Botanical Garden. The method of inoculation experiment is quite similar to that for the former species. About ten

days after inoculation, numerous uredosori appeared on the inoculated leaves of the host plant.

TRANZSCHEL[1] reported in his paper, *Peridermium* on *Pinus pumila* collected in Kamchatka as *Coleosporium* sp. He described only the short diagnose of the aecidial stage in Russian, and did not write any remarks of its teleuto-host. But, the description of his fungus is incomplete, so the writer can not compare it with the aecidial stage of *Coleosporium Saussureae* THÜM.

The writer mentioned above that *Coleosporium Eupatorii* and *C. Saussureae* produce the aecidial stage on *Pinus koraiensis* and *P. pumila*, respectively. These two species of *Pinus* belong to the same section *Strobus*.

III. The description of *Coleosporium Eupatorii* ARTH. and *C. Saussureae* THÜM.

1. Coleosporium Eupatorii ARTHUR

in Bull. Torr. Bot. Club, XXXIII, p. 31, 1906; in N. Amer. Fl. VII, p. 90 (1907), p. 654 (1924)—SACC. Syll. XXI, p. 719—SYD. Monogr. Ured. III, p. 607. (FUJIKURO in Transact. Formosa Nat. Hist. Soc. XIX, p. 9, 1914).

Syn. *Coleosporium Yamadai* MIURA in sched.

Spermogonia subepidermal, low-conical, 0.57–0.76 mm. long by 0.28–0.6 mm. broad, 55.8–64.8 μ high.

Aecidia hypophyllous, flattend laterally, 0.8–3.0 mm. long by 1.0–1.8 mm. high; pseudoperidia delicate, hyaline; peridial cells ovoid to ellipsoid in face view, 50.4–72.0 × 23.4–34.2 μ, often acutish at one or both ends, slightly overlapping and easily separating, the side walls 5.4–10.0 μ thick, the inner wall rather finely verrucose with low papillae of irregular outline; aecidiospores oblong, 23.4–32.4 × 18.0–23.4 μ; epispore 1.8–3.0 μ, closely and moderately verrucose.

Uredosori hypophyllous, scattered, small, round, 0.2–0.3 mm. across, soon pulverulent, brownish yellow to pale yellow; uredospores globose, ellipsoidal or ovate, 18.0–27.0 × 15.0–21.0 μ; epispore densely verrucose, colourless, 1.5–2.0 μ thick; contents pale yellow to hyaline.

1) l. c.

Teleutosori hypophyllous, scattered or gregarious, small, round or ovate, 0.2–0.8 mm. in diam., reddish yellow to orange; teleutospores cylindrical or prismatic, 49.8–81.0 × 14.4–21.0 μ, apex 7.2–14.4 μ thick, hyaline; epispore thin; contents pale yellow.

Hab. On leaves of *Pinus koraiensis* SIEB. et ZUCC. (*Chôsen-matsu*). *Hokkaidô*:

Prov. Ishikari: Mt. Moiwa (O, I, May 19, 1924; O, I, June 17 & June 21, 1925, NAOHIDE HIRATSUKA).

On leaves of *Eupatorium japonicum* THUNB. (*Hiyodori-bana*). *Hokkaidô*:

Prov. Ishikari: Maruyama (II, III, Aug. 29, 1923; II, III, Sept. 24, 1924, NAOHIDE HIRATSUKA).

Hab. On leaves of *Eupatorium sachalinense* MAK. (*Yotsuba-hiyodori*). *Hokkaidô*:

Prov. Oshima: Mt. Komagatake (II, III, Sept. 28, 1924, NAOHIDE HIRATSUKA). Prov. Ishikari: Maruyama (III, Oct. 25, 1896, G. YAMADA); Mt. Moiwa (II, July 31, 1925; II, Aug. 25, 1924; II, III, Sept. 4, 1923; II, III, Sept. 14, 1924; II, III, Oct. 7, 1925, NAOHIDE HIRATSUKA); Yuni (II, III, Sept. 9, 1899, G. YAMADA); Nopporo (II, III, Sept. 26, 1926, Y. HOMMA). *Honshû*:

Prov. Mutsu: Sukayu (II, III, Sept. 26, 1926, S. ITÔ & NAOHIDE HIRATSUKA).

Distrib. Central & South America, Cuba and Japan.

2. Coleosporium Saussureae THÜMEN

in Bull. Soc. Impér. Nat. Moscou, LV, p. 212, 1880—SACC. Syll. VII, p. 757—SYD. Monogr. Ured. III, p. 614.

Syn. *Coleosporium Saussureae* DIET. in Engl. bot. Jahrb. XXXIV, p. 588, 1905—SACC. Syll. XXI, p. 719. (DIET. in Engl. bot. Jahrb. XXXVII, p. 107, 1906).

C. japonicum MIURA in sched.

Spermogonia subepidermal, low-conical, conspicuous, brown, dehiscent by

a longitudinal slit, 0.7–1.2 mm. long by 0.3–0.5 mm. broad, 98.0–140 μ high.

Aecidia amphigenous, mostly hypophyllous, one or two in rows on slightly discoloured spots occupying part of a leaf, erumpent from longitudinal slits, 0.5–1.6 mm. long, 0.3–0.6 mm. high; pseudoperidia delicate, colourless; peridial cells oblong or lanceolate-oblong in face view, somewhat overlapping, easily separating, 45.0–61.2 × 25.2–30.6 μ, often acute at both ends, inner epispore thicker, 7.2–10.8 μ, closely verrucose; aecidiospores subglobose to oblong, 23.4–34.2 × 18.0–23.4 μ; epispore ca. 2.0 μ thick, minutely verrucose.

Uredosori hypophyllous, minute, 0.25–0.6 mm. across, scattered or circularly arranged or sometimes irregularly grouped, soon pulverulent, orange-yellow; uredospores variable in shape, generally ellipsoidal or ovate, 21.6–27.0 × 12.0–18.0 μ; epispore densely verrucose, rather thin and hyaline; contents pale yellow.

Teleutosori hypophyllous, small, round, scattered or gregarious, reddish yellow to yellowish orange; teleutospores cylindrical or prismatic, 60.0–115.0 × 15.0–23.4 μ; apex 18.0–25.2 μ thick, hyaline; contents pale orange-yellow.

Hab. On leaves of *Pinus pumila* REGEL. (*Hai-matsu*).

Hokkaidô:

Prov. Ishikari: Mt. Kuro-dake (O, I, July 26, 1926, S. ITÔ & NAOHIDE HIRATSUKA).

On leaves of *Saussurea japonica* DC. (*Hime-higotai*).

Honshû:

Prov. Rikuchû: Barajima (Morioka) (III, Sept. 24, 1903, T. SOMEYA; III, Sept. 11, 1904, K. SAWADA); Hakomine (Morioka) (III, Oct. 1, 1905, K. SAWADA).

Shikoku:

Prov. Tosa: Jigoku-tani (II, III, June, 1903, T. YOSHINAGA); Akinokawa (II, III, Oct., 1903, T. YOSHINAGA). Prov. Iyo: Shintate (II, III, Oct. 20, 1906, T. NISHIDA).

On leaves of *Saussurea Maximowiczii* HERD. (*Miyama-azami*).

Honshû:

Prov. Shimotsuke: Nikkô (II, III, Sept., 1904, S. KUSANO).

On leaves of *Saussurea Riederi* HERD. (*Kita-azami*).

Hokkaidô:

Prov. Ishikari: Mt. Kuro-dake (II, III, Aug. 4, 1925, NAOHIDE HIRATSUKA; II, III, Aug. 19, 1925, K. MIYABE & NAOHIDE HIRATSUKA; II, III, Sept. 12, 1926, NAOHIDE HIRATSUKA).

On leaves of *Saussurea Tanakae* FR. et SAV. (*Tôhiren*).

Honshû:

Prov. Rikuchû: Mt. Iwate (III, Aug. 30, 1903, K. SAWADA).

On leaves of *Saussurea ussuriensis* MAXIM. (*Kiku-azami*).

Houshû:

Prov. Musashi: Mt. Takao (II, June, 1904, N. NAMBU).

Distrib. Siberia, China, Kamchatka and Japan.

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摘　　要

本報文ニ於テハ菊科ニ寄生スル本邦産[コレヲスポリウム]中、*Coleosporium Eupatorii* ARTH. 及ビ *C. Saussureae* THÜM. ノ二種ニ就キテ特ニ今日ニ到ルマデ知ラレザリシ其ノ生活史ヲ明カニセリ。

即チ、前者ハ本邦ニ於テハ通常**ヒヨドリバナ**及ビ**ヨツバヒヨドリ**ニ寄生スルモノニシテ、研究ノ結果、**テフセンマツ**ニ其ノ銹子腔時代ヲ經過スル事ヲ知レリ。更ニ後者ハ今日調査セル範圍ニテハ本邦ニ於テハ其ノ夏胞子及ビ冬胞子時代ヲ**タウヒレン**、**キタアザミ**、**ヒメヒゴタイ**、**ミヤマアザミ**及ビ**キクアザミ**ノ五種上ニ經過シ、銹子腔ヲ**ハヒマツ**上ニ形成スル事ヲ明カニセリ。