

観賞植物のさび病(2)

*Puccinia sessilis*によるアマドコロ類およびマイヅルソウのさび病

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著者名	柿島,真 佐藤,昭二
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Rust Diseases of Ornamental Plants (II)* Rusts of Solomon's Seal and Lily of the Valley Caused by *Puccinia sessilis***

Makoto KAKISHIMA*** and Shoji SATO***

Key words: rust disease, life cycle, *Puccinia sessilis*, *Polygonatum*, *Maianthemum*.

In spring, the spermogonial and aecial stages of rust fungi on Solomon's seal (*Polygonatum* spp.) and lily of the valley (*Maianthemum* sp.) are observed both in the garden and in the field in Japan. These rust fungi have been speculated as the spermogonial and aecial stages (*Aecidium convallariae* Schum.=*A. majanthae* Schum.) of *Puccinia sessilis* Schneider according to the results of inoculation experiments carried out in Europe and taxonomic treatment¹⁻³). Ito⁴⁾ inoculated *Polygonatum odoratum* (Mill.) Druce var. *maximowiczii* (Fr. Schn.) Koidz. and *Maianthemum dilatatum* (Wood) Nels. et Macbr. with basidiospores of *P. sessilis*. However, he could not get any successful infections. We report here the successful, reciprocal inoculation experiments with basidiospores of *P. sessilis* and aeciospores on *Po. falcatum* A. Gray, and include the morphological observations of the causal rust fungus.

Symptoms and signs of the disease. Minute, yellow to orange yellow spermogonia appear in groups on leaves, stems or petioles. These spermogonia secrete nectar droplets containing spermatia. Yellow to purple lesions on the leaves (5-15 mm in diameter) consist of groups of spermogonia. After fertilization, spermogonia change color from yellow to dark brown, and then pale yellow aecia begin to appear on leaves, stems or petioles where spermogonia have been produced. Many aecia develop in the same lesion in groups. The aecia are usually up to 2 mm in length, cup-shaped, and produce a lot of powdery, yellow aeciospores when they mature. The leaves would eventually die if many lesions appeared on them.

Inoculation experiments. In spring of 1979, we found the spermogonial and aecial stages on the leaves of *Po. falcatum* and *Po. odoratum* var. *pluriflorum* (Miq.) Ohwi in Ibaraki Pref. and Nagano Pref. We also noted the telial stages of *P. sessilis* on *Phalaris arundinacea* L. near *Aecidium*-infected *Polygonatum* spp. Therefore, we suspected a genetic relation between these two rust fungi and carried out inoculation experiments to clarify their life cycle.

Fallen leaves and stems of *Ph. arundinacea* from the previous year and bearing abundant telia of *P. sessilis* were collected at Mt. Tsukuba, Ibaraki Pref., on April 20, 1980, and kept in a refrigerator at ca. 5 C until use. Teliospores from telia germinated well under saturated humidity at room temperature to produce basidia and basidiospores. Plants belonging to Liliaceae were planted in clay pots. Teliospores producing basidiospores were inoculated on young, healthy leaves, as shown in Table 1. The inoculated plants were sprayed with distilled water,

* (I): Kakishima, M. *et al.* (1985). Ann. Phytopath. Soc. Japan 51: 623-626.

** Contribution No. 69, Laboratories of Plant Pathology and Mycology, Institute of Agriculture and Forestry, University of Tsukuba.

*** Institute of Agriculture and Forestry, University of Tsukuba, Tsukuba, Ibaraki 305, Japan 筑波大学農林学系

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placed in a dark, moist chamber at ca. 20 C for 2 days, and then transferred into a growth chamber controlled at ca. 20 C with artificial illumination. Inoculations were carried out several times in April to May 1980.

Results of inoculation experiments are shown in Table 1. Six to eight days after inoculation, minute, yellow spermogonia appeared on the inoculated leaves of *Po. lasianthum* Maxim., *Po. odoratum* var. *pluriflorum*, and *Po. falcatum*, and then 7 to 9 days later, pale yellow aecia were formed in the lesions of spermogonia (Fig. 1). Period required for the first appearance of spermogonia and aecia on *M. dilatatum* was longer than that on *Polygonatum* spp. No signs of infection were found on the other plants inoculated.

Return inoculations were made on *Ph. arundinacea* with three inocula: aeciospores on *Po. falcatum* and *M. dilatatum* obtained by basidiospore inoculation; and aeciospores on *Po. falcatum* collected at Mt. Tsukuba in June, 1980. Aeciospores were dusted on wet filter papers (ca. 3×3 mm) with a surgical knife. The spore-dusted papers were placed on both surfaces of healthy leaves and stems of *Ph. arundinacea*. The inoculated plants were treated as described above. Ten to twelve days after inoculation, yellow to orange yellow uredinia appeared on the inoculated leaves and stems in the three inoculations, and then about 3 months later, brown to black telia were formed under the epidermis of the leaves and stems.

Results of inoculation experiments mentioned above confirmed that the spermogonial and aecial stages of *P. sessilis* occur on *Polygonatum* spp. and *M. dilatatum*.

Morphology of the rust fungus. Morphological observations of dry herbarium specimens were made by light and scanning electron microscopy by the method reported previously⁵⁾.

Spermogonia and aecia were produced on the leaves, stems and petioles of *Po. lasianthum*, *Po. odoratum* var. *pluriflorum*, *Po. falcatum* and *M. dilatatum*. Spermogonia were amphigenous, numerous in a group, minute, and yellow to orange yellow. In vertical section spermogonia were subepidermal and flask-shaped, belonging to type 4 of Hiratsuka and Cummins⁶⁾ (Fig. 2). Spermatia produced in spermogonia were ellipsoid to obovoid. Aecia were mostly hypophyllous, rarely epiphyllous, cupulate and pale yellow with long peridia (Fig. 1). Peridial cells were concave, polygonal with verrucose inner walls, and firmly connected to each other. Aeciospores were globose to broadly ellipsoid, often angular, and 21.0~29.0×17.5~26.0 µm in size (Figs. 3, 6). Walls were 1.5~2.0 µm, hyaline, verrucose, and type 3 of Savile⁷⁾.

Table 1. Results of inoculation experiments with basidiospores of *Puccinia sessilis* on *Phalaris arundinacea*

Plant inoculated	No. of inoculations	Period (days) required for the first appearance of	
		spermogonium	aecium
<i>Disporum sessile</i> Don	3	— ^{a)}	—
<i>D. smilacinum</i> A. Gray	2	—	—
<i>Erythronium japonicum</i> Decne.	2	—	—
<i>Hemerocallis fulva</i> L. var. <i>kuwanso</i> Regel	2	—	—
<i>Lilium cordatum</i> (Thunb.) Koidz.	2	—	—
<i>Maianthemum dilatatum</i> (Wood) Nels. et Macbr.	2	10	21-23
<i>Polygonatum lasianthum</i> Maxim.	3	6-8	14-15
<i>P. odoratum</i> (Mill.) Druce var. <i>pluriflorum</i> (Miq.) Ohwi	4	6-7	14-16
<i>P. falcatum</i> A. Gray	6	6-7	13-15

a) no appearance of spermogonium or aecium.

- 5) Kakishima, M., Yamamoto, T. and Tagami, M. (1985). Ann. Phytopath. Soc. Japan 51: 623-626.
 6) Hiratsuka, Y. and Cummins, G.B. (1963). Mycologia 55: 487-507.

Uredinia and telia were produced on the leaves and stems of *Ph. arundinacea*. Uredinia were amphigenous, scattered, minute, and yellow to brown. Urediniospores were subglobose to broadly ellipsoid, and $21.0\sim34.5\times15.5\sim32.0\ \mu\text{m}$ in size (Fig. 4). Walls were $1.5\sim2.0\ \mu\text{m}$ thick, pale brown, and echinulate with 6 to 8 scattered germ pores (Fig. 7). Telia were amphigenous, produced under the epidermis, covered by them for a long time, and dark brown to black. Teliospores were oblong-clavate with round to acuminate apices, slightly constricted at the septa, and $27.5\sim57.5\times14.5\sim24.0\ \mu\text{m}$ in size. Teliospore walls were $1\sim2\ \mu\text{m}$ at the sides, $2.5\sim5.5\ \mu\text{m}$ at the apices, pale brown to brown, and smooth (Fig. 5). The pedicels were short, hyaline, and deciduous.

Taxonomy of the rust fungus. The morphology of the spermogonial, aecial, uredinal and telial stages agreed with the descriptions of *P. sessilis*^{1,3,8,12)}. Therefore, we identified this rust fungus as *P. sessilis*. The spermogonial and aecial stages of *P. sessilis* have been known to occur on many species of Liliaceae in Europe^{2,3)}, North America⁸⁾, and Japan^{9,10,11)}. In Japan, Hiratsuka and Sato⁹⁾ demonstrated by inoculations that the spermogonial and aecial stages of *P. sessilis* were produced on *Hosta longissima* Honda var. *brevifolia* F. Maekawa, and treated *Aecidium hostae* Dietel as a synonym of *P. sessilis*. Harada¹¹⁾ also proved by inoculations that *H. rectifolia* Nakai was a spermogonial and aecial host of *P. sessilis*. Because of the wide aecial host range of *P. sessilis*, further taxonomic study including physiological specialization is required. Cummins¹²⁾ described a new variety, *P. sessilis* var. *minor* Cummins, from the United States on *Ph. angusta* Nees ex Trin. and *Ph. caroliniana* Walt. to distinguish from the main variety, *P. sessilis* var. *sessilis*, on *Ph. arundinacea*¹³⁾.

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和 文 摘 要

柿島 真・佐藤昭二：観賞植物のさび病 (II) *Puccinia sessilis* によるアマドコロ類およびマイヅルソウのさび病

アマドコロ類（アマドコロ，ナルコユリ，ミヤマナルコユリ）およびマイヅルソウに精子・さび胞子世代を形成するさび病菌について，接種試験ならびに形態観察を行い，その生活史と病原菌の形態を明らかにした。すなわち，これらの夏胞子・冬胞子世代はクサヨシに形成され，病原菌は *Puccinia sessilis* であることが明らかとなった。

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Explanation of plate

Plate I

- Fig. 1. Aecia on *Polygonatum falcatum* produced by basidiospore inoculation.
- Fig. 2. Vertical section of a spermogonium on *Polygonatum falcatum*.
- Fig. 3. Aeciospores produced by basidiospore inoculation.
- Fig. 4. Urediniospores produced by aeciospore inoculation.
- Fig. 5. Teliospores collected at Mt. Tsukuba and used as inocula for basidiospore inoculation.
- Fig. 6. Aeciospores with verrucose surfaces observed by SEM.
- Fig. 7. Urediniospores with echinulate surfaces observed by SEM.

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Plate I

