Rust Diseases of Ornamental Plants (I) Rust of Begonia Caused by *Pucciniastrum boehmeriae**

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Key Words : rust disease, begonia, *Pucciniastrum boehmeriae*, *Begonia hiemalis*, *Boehmeria spicata*.

In June, 1982, a rust disease was observed on begonia for the first time in Japan in a greenhouse in Kuwana-shi, Mie Prefecture. We report here the results of study on the morphology and taxonomy of the causal rust fungus, including inoculation experiments.

Symptoms and signs of the disease At first, small, brown lesions appear on the leaves of begonia, which later increase in size and become dark brown. Minute, yellow uredinia occur on the lower leaf surfaces when dark brown lesions reach a diameter of 3-5 cm. Many uredinia appear in circles (Fig. 1). As the disease progresses, lesions coalesce to spread all over the leaves leading eventually to the death of the leaves.

Observations in fields In Mie Pref., rust disease of begonia has been found on elatior begonia (*Begonia hiemalis* Fotsch.) in greenhouses. Most of these begonias had been grown in greenhouses in Namiai-mura, Nagano Pref. (ca. 800 m above sea level) and transferred to Mie Pref. at the end of the previous summer. Therefore, as we considered that these begonias had been infected with a rust fungus in the greenhouses in Namiai-mura, we surveyed and collected a large number of rust fungi on plants around the greenhouses. One of these rust fungi, *Pucciniastrum boehmeriae* P. et H. Sydow on *Boehmeria spicata* (Thunb.) Thunb. which was found to occur near the greenhouses produced abundant uredinia on the leaves in late summer (Fig. 2). From these observations, we assumed that there was a genetic relation between the rust on begonia and that on *Boehmeria spicata*.

Inoculation experiments Inoculation experiments were carried out in order to ascertain the relationship between the rust fungi on begonia and *Boehmeria spicata*. Urediniospores on *Begonia hiemalis* collected in Mie Pref. were dusted on wet filter papers (ca. 3×3 mm) with a surgical knife. The spore-dusted papers were placed on the lower surfaces of healthy leaves of *Boehmeria spicata*. The inoculated plants were sprayed

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with distilled water, placed in a dark, moist chamber at ca. 20 C for 1 day, and then transferred into a growth chamber controlled at ca. 20 C with artificial illumination. Eight to ten days after the inoculation, minute, light yellow uredinia appeared on the lower surfaces of the inoculated leaves (Figs. 3, 4). Telia were also produced ca. 4 months later.

Inoculation experiments with urediniospores of *Pucciniastrum boehmeriae* were also carried out by the same method as that described above. Urediniospores on *Boehmeria spicata* collected near the greenhouses in Namiai-mura were inoculated onto *Begonia hiemalis*. Six to eight days after the inoculation, dark brown lesions appeared on the inoculated leaves, and 4 to 6 days later, minute, yellow uredinia were formed on the lower leaf surfaces. No telia were observed on the leaves. Furthermore, urediniospores on *Boehmeria spicata* collected in Mt. Fuji, Yamanashi Pref. on October 8, 1984 were inoculated onto *Begonia hiemalis*. After inoculation, the symptoms and signs described above appeared on the inoculated plants. However, telia were not produced on the leaves.

The cross inoculation experiments with urediniospores on *Begonia hiemalis* and *Boehmeria spicata* confirmed the existence of a genetic relation between these rusts.

Morphology of the rust fungus on begonia Morphological observations of dry herbarium specimens were made by light and scanning electron microscopy (SEM). The urediniospores and sections of uredinia cut by hand were mounted in 0.5% KOH solution or lactophenol solution on glass slides for light microscopic observation. For SEM, the urediniospores and sections of uredinia were placed on adhesive tape laid on specimen holders, and coated with gold with an Eiko IB-3 Ion Coater. The preparations were examined with a Hitachi S-430 SEM operating at 20 kV.

Uredinia were hypophyllous, subepidermal, minute and yellow to light yellow with peridia (Fig. 6). The peridia were hemispherical, firm, and they ruptured at the apex. Peridial cells were concave, polygonal and smooth. Ostiolar cells were rounded and smooth. Urediniospores were subglobose to ellipsoid, and $16-24 \times 12-17 \mu\text{m}$ in size. Walls of urediniospores were hyaline, echinulate and ca. $1.5 \mu\text{m}$ thick (Figs. 5, 7). Teliospores could not be observed on begonia.

Taxonomy of the rust fungus Morphology of uredinia and urediniospores on begonia was similar to that described in *Pucciniastrum boehmeriae*^{1,2)}. Teliospores on *Boehmeria spicata* produced by inoculation experiments with urediniospores on *Begonia hiemalis* were also morphologically similar to those of *Pucciniastrum boehmeriae*. Therefore, we identified the rust fungus on begonia as *Pucciniastrum boehmeriae*.

Pucciniastrum boehmeriae has been known as a rust fungus which produces uredinial and telial stages on *Boehmeria* spp. and *Cypholophus* sp. (Urticaceae)^{1,3)}. It has been reported in Japan¹⁻³⁾, Taiwan^{3,4)}, The Philippines^{1,3)}, Papua New Guinea³⁾ and Indonesia⁵⁾. Therefore, further inoculation experiments with urediniospores collected from various places should be performed to analyse the pathogenicity of the fungus on begonia along with the host range and physiological specialization of the rust fungus.

Recently, Kaneko and Hiratsuka⁶⁾ reported that spermogonial and aecial stages of *Pucciniastrum boehmeriae* were produced on *Abies firma* Sieb. et Zucc. in Tottori Pref,

We wish to express our thanks to Drs. S. Sato and K. Katsuya, Institute of Agriculture and Forestry, University of Tsukuba for their suggestions, and Dr. Y. Ono, Faculty of Education, Ibaraki University for his cooperation in the field surveys of rust fungi in Mamiai-mura, Nagano Pref.

和 文 摘 要

柿島 真・山本敏夫・田上征夫：観賞植物のさび病(Ⅰ) *Pucciniastrum boehmeriae* によるベゴニアさび病

1982年6月三重県桑名市で温室栽培のベゴニアに初めてさび病の発生が認められた。野外調査、接種試験などから、このベゴニアさび病は長野県でイラクサ科のコアソソ上に自然発生しているさび病と同一のものであることを明らかにし、また、病原菌の形態観察の結果から、この病原菌を *Pucciniastrum boehmeriae* P. et H. Sydow と同定した。

(Received July 31, 1985)

Explanation of plate

Plate I

- Fig. 1. Uredinia (arrows) produced on the lower leaf surface of *Begonia hiemalis*. (Bar=5mm)
- Fig. 2. *Boehmeria spicata* near a greenhouse in Namiai-mura, Nagano Pref. (Bar=5cm)
- Figs. 3, 4. Uredinia (arrow) produced on the lower leaf surface of *Boehmeria spicata* by inoculation experiments with urediniospores on *Begonia hiemalis*. (Fig. 3, Bar=5 mm; Fig. 4, Bar=1mm)
- Fig. 5. Urediniospores on *Begonia hiemalis*. (Bar=10 μ m)
- Fig. 6. Section of a uredinium on *Begonia hiemalis* observed under SEM. Presence of urediniospores (U), peridial cells (P) and ostiolar cells (O) (Bar=10 μ m)
- Fig. 7. An urediniospore on *Begonia hiemalis* observed under SEM. (Bar=1 μ m)

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Plate I