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Author(s)	ITO, Seiya
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CONTRIBUTIONS TO THE MYCOLOGICAL FLORA
OF JAPAN. II.⁽¹⁾

On the Uredineae Parasitic on the Japanese Gramineae.

By

Seiya Itō, *Nōgakushi*.

(With Plates X—XII)

INTRODUCTION.

The annual loss owing to the rust of cereals is often quite enormous. In Europe and America, the disease has consequently attracted a good deal of attention from old times.

In 1864-'65 DE BARY (1) proved scientifically for the first time the genetic relation between *Puccinia graminis* Pers., and *Æcidium Berberidis* Gmel. The discovery of the heteroecism in the cereal rusts may be regarded as the starting point in the history of the scientific investigations of the rust-fungi. In 1896, J. ERIKSSON with his assistant E. HENNING published "Die Getreideroste," which is regarded as a classical work on the subject in question. The appearance of this great work has stimulated the investigation on the same subject by botanists in many countries. Their attention has especially been turned to biological questions. Among the investigators on the subject, the name of P. DIETEL, E. FISCHER, Fr. BUBÁK, T. SOPPITT, P. SYDOW, W. TRANZCHEL, MARSHALL WARD, H. KLEBAHN and A. CARLETON are never to be forgotten by the students of Phytopathology. Recently, POLE EVANS (1) has contributed the idea, that many biological species can also be recognized by their cytological characters. On the other hand, the study of the sexual processes in the Uredineae has made a remarkable progress for the last four or five years. And the relation of the cereal rust to

(1) Prepared under the direction of Prof. Dr. K. MIYAKE.

Contributions. I.—T. MIYAKE, On *Puccinia* Parasitic on the Umbelliferae of Japan. Journ. of the Sapporo Agric. Coll. Vol. II. Pt. 3. 1906.

climate has also been studied by many scholars. Moreover, the question of the propagation of the rust fungi has been fully discussed by ERIKSSON, MARSHALL WARD, KLEBAHN and other botanists.

In our country, very little has as yet been done in regard to the investigations of the biological characters as well as of the preventive means of the rust fungi. But to carry out such investigations satisfactorily, the classification based on careful morphological studies must first be undertaken.

Messrs. Y. TAKAHASHI (1)(2) and A. MABE (1) made some systematic studies of the rust fungi of our cereals. Mr. S. HORI (1)(2) published the result of his study on *Puccinia corticioides* Berk. et Br., Mr. K. YOSHINO (1) on the rust of *Setaria italica* Beauv. var. *germanica* Trin., and recently Prof. S. KUSANO (2) published a monograph of *Puccinia* on the leaves of Bambuseae, in which he described two new species, *Puccinia Phyllostachydis* and *Puccinia Sasae*, and a new variety, *Puccinia Kusanoi* Diet. var. *Azuma*. Besides those works, there are none yet published in our country relating to the Uredineae on Gramineae. Most of our species were identified and described by European mycologists—BERKELEY, DIETEL, SYDOW, P. HENNINGS and MAGNUS.

A large number of the specimens of the Uredineae on the Japanese grasses preserved in the Herbarium of our University were kindly placed in my hand by Prof. K. MIYABE for the preparation of the present paper. Besides them, many interesting and valuable specimens were kindly sent at my request by Profs. M. SHIRAI, S. KUSANO and G. YAMADA, Messrs. Y. TAKAHASHI, A. IDETA, T. NISHIDA, T. KAWAKAMI, J. HANZAWA, T. MIYAKE, R. SUZUKI, M. MIURA, M. KASAI, N. NAMBU, K. YOSHINO, T. YOSHINAGA and T. KURIHARA. All these specimens are now preserved in our University Herbarium.

The specimens have been collected from different parts of Japan, from Saghalien and Kurile Islands on the north, to Formosa on the south. The total number of specimens I have examined is about 800, in which six genera, 73 species and 2 varieties are included. They are as follows:—*Uromyces* 4 sps., and 1 var., *Puccinia* 58 sps., and 1 var., *Diorchidium* 1 sps., *Stereostromium* 1 sps., *Rostrupia* 2 sps., and *Uredo* 7 sps.

Among these species, those which are newly added to the Japanese mycological flora are 28 species and 1 variety, those which seem to me as entirely new and are described as such in this paper are 21 species and 1 variety; and 39 species and 2 varieties are endemic to Japan.

I wish to express here my heartiest thanks to Prof. Dr. K. MIYABE to whom I am indebted for his many valuable suggestions and his constant kind direction. To the gentlemen, above mentioned, who have kindly helped me by sending valuable and interesting specimens, I express my sincere thanks. I wish also to acknowledge my indebtedness to Messers. Y. TAKAHASHI, J. HANZAWA and T. MIYAKE, who have kindly helped me in many ways.

SPECIAL PART.

UROMYCES Link.

A. Teleutospores provided with coronate apex.

1. *Uromyces ovalis* Diet. in Engl., Bot. Jahrb., **37**, 1905, (97).—(Pl. X. Fig. 1.)

Hab. On *Leersia oryzoides* Sw. var. *japonica* Hack.

Honshū.—Prov. Musashi: Kami-Itabashi (II. & III. Oct. 29, 1904. S. KUSANO).

Distrib. Japan.

REMARKS. I was fortunate enough to examine the original specimen of this species by the kindness of Prof. S. KUSANO, and that is the only specimen, I have examined.

In 1905, DIETEL (9) noted the affinity of this species to *Uromyces Halstedii* De Toni of North America. He remarked that it is hard to distinguish our species by uredospores only from *Uromyces Halstedii*. But in the case of teleutospores, their difference is evident. In *Uromyces Halstedii*, the paraphyses are hyaline, the teleutospore wedge-shaped at base, and broadly truncate at apex; the general shape is triangular, and it is larger in measurement; and the pedicel is shorter; while in *Uromyces ovalis*, the paraphyses are light brown, the teleutospore rounded or attenuated at base and rounded at apex, the general shape being spherical obovate or obovate,

the size smaller ($18-30 \times 13-19 \mu$) and the pedicel as long as the spore or sometimes longer.

2. *Uromyces coronatus* Miyabe et Nishida. Diet., Bot. Centralb., **105**, 1907, (494).—(Pl. X. Fig. 2.)

Syn.: *Uromyces coronatus* Yoshinaga. Diet., in Ann. Mycol., **5**, 1907, (70).

Hab. On *Zizania aquatica* L.

Honshū.—Prov. Musashi: Akabane (III. Oct. 22, 1902. K. YOSHINO); Komaba (II. July 16, 1906. T. KARASHIMA).—Prov. Echigo: Yoshikawa-mura (II. July 24, 1903. K. YOSHINO).

Shikoku.—Prov. Tosa: Ushioe-mura (II. & III. Oct. 1906. T. YOSHINAGA); Kōchi (III. Jan. 1, 1907. S. KUSANO).

Kiushū.—Prov. Higo: Kamino-mura (II. June 6, 1906. H. MATSUO).—Prov. Chikuzen Yanagawa (II. Sept. 17, 1906. K. YOSHINO).

Formosa.—Daihoku (II. Dec. 5, 1905. T. KAWAKAMI and R. SUZUKI; II. T. KAWAKAMI).

Distrib. Japan.

REMARKS. DIETEL (10) makes a remark that this fungus is closely related to *Uromyces ovalis* Diet. From my own observations, however, these two species evidently differ from each other in various points; that is, in color and shape of uredospores, in the dimension of teleutospores and pedicels and also in the shape of the sorus, as shown in the following table:—

	<i>U. ovalis</i>	<i>U. coronatus</i>
II. Color of spore	Light brown or brownish yellow.	Yellowish brown, apex darker.
Shape of spore	Globose, ellipsoidal or obovate.	Ellipsoidal, obovate or globose.
Germ-pores	5.	3-4.
III. Size of spore	$18-30 \times 13-19 \mu$.	$20-40 \times 10-22 \mu$.
Pedicel of spore	$30-40 \mu$ in length.	$30-45 \mu$ in length.
Shape of sorus	Oblong.	Linear or oblong.

B. Teleutospores not provided with coronate apex.

a. Teleutosori covered by epidermis.

3. *Uromyces Alopecuri* Szym. in Proc. Boston Soc. Nat. Hist., **24**, 1889,

(186); Sacc., Syll., 9, 1891, (295); Dietel, in Engl., Bot., Jahrb., 32, 1903, (47).

var. *japonica* S. Ito. n. var.—(Pl. X. Fig. 3.)

Uredosori, amphigenous, mostly hypophyllous, or on the sheath, small, round or oblong, scattered or gregarious, often confluent, naked, with the torn epidermis, powdery, or sometimes loosely covered by the epidermis, especially on the sheath, orange-colored. Uredospores, subglobose or broadly ellipsoidal, minutely or prominently verrucose, $16-28 \times 14-27 \mu$; epispore thick; paraphyses absent.

Teleutosori, amphigenous, mostly hypophyllous, or on the sheath and culm, those on the blade small, round or oblong, scattered, rarely confluent; those on the sheath and culm, small, round, oblong or linear, scattered or gregarious, often confluent; long covered by epidermis, somewhat pulvinate, not prominent, greyish black. Teleutospores, globose, obovate or polygonal, apex more or less thickened ($3-4 \mu$) and rounded, truncate or obliquely pointed, base rounded or slightly attenuated, brownish yellow, darker at apex, $18-29 \times 15-21 \mu$; epispore $1-1.5 \mu$ thick; pedicels brown, persistent, as long as the spore or sometimes little longer.

Hab. On *Alopecurus fulvus* L.

Hokkaidō.—Prov. Ishikari: Sapporo (II. June 20, 1891. K. MIYABE); Nopporo (II. & III. July 27, 1905. J. HANZAWA); Garugawa (II. Sept. 22, 1907. S. ITŌ); Iwamizawa (II. July 10, 1908. S. ITŌ).—Prov. Iburi: Mororan (II. & III. June 10, 1900. K. MIYABE).

Honshū.—Prov. Rikuchū: Morioka (II. & III. May 30, 1903. G. YAMADA; II. July 3, 1907. M. MIURA).—Prov. Musash: Tokyo (II. & III. July 1899; II. May 2, 1899. S. KUSANO); Nishigahara (II. & III. June 22, 1896. S. HORI; II. Nov. 29, 1899. T. NISHIDA); Kawaguchi (II. & III. May 31, 1906. N. NAMBU); Aoyama (II. & III. June 1902. K. YOSHINO).—Prov. Yamashiro: Kyoto (III. July 14, 1895. Y. TAKAHASHI); Kujō-mura, Kyoto (II. & III. June 8, 1895. N. HIRATSUKA).

Shikoku.—Prov. Iyo: Sugō-mura (II. May 22, 1899. K. OKUDAIRA).

Kiushū.—Prov. Chikuzen: Ōmuda (II. April 23, 1905. K. YOSHINO).—Prov. Higo: Imizu-mura (II. & III. May 26, 1904. K. YOSHINO); Mt. Aso (II. & III. July 13, 1906. J. HANZAWA & K. YOSHINO); Kumamoto (II. & III. June 2, 1907. T. NISHIDA).

Formosa.—Daihoku (II. & III. April 5, 1907. T. KAWAKAMI & R. SUZUKI).

On *Alopecurus japonicus* Steud.

Kiushū.—Prov. Higo: Imizu-mura (III. May 25, 1905. S. MAIHARA).

Distrib. Japan.

REMARKS. Comparing our specimens with the description of the American

Uromyces Alopecuri Seym. (1), I find the following points of difference:—

1. The uredosori are amphigenous or hypophyllous in our species and not epiphyllous as in the American species.

2. The measurement of our uredospores is a little larger (27 or 28 μ against 24 μ).

3. Though the teleutosori are written as epiphyllous, they are mostly hypophyllous in our species and also most commonly formed at the basal part of the sheath.

Although the essential characters of the uredospores and teleutospores are practically the same, the above mentioned differences in character being constant, I think it better to treat our plant as a variety of the American *Uromyces Alopecuri*.

4. **Uromyces Setariae italicae** (Diet.) Yoshino., in Bot. Mag. Tokyo, **20**, 1906, (247).—(Pl. X. Fig. 4.)

Syn.: *Uredo Setariae italicae* Diet., in Engl., Bot. Jahrb., **32**, 1903, (632); Sacc., Syll., **17**, 1905, (457); Sydow & Butler, in Ann. Mycol., **4**, 1906, (444).

Uredosori = *Uredo Setariae italicae* Diet.

Teleutosori, mostly hypophyllous or on the sheath; minute, oblong or roundish, scattered or gregarious, commonly not confluent, long covered by epidermis, somewhat pulvinate, inconspicuous, greyish-black. Teleutospores, spherical, obovate or oblong, mostly angular, apex not or slightly thickened, and rounded or truncate, base rounded or attenuated, brownish yellow or yellowish, 20–30 \times 16–24 μ ; epispore thick (2–3 μ); pedicels persistent, hyaline or subhyaline, as long as the spores.

Hab. On *Setaria italica* Beauv. var. *germanica* Trin.

Honshū.—Prov. Musashi: Tokyo (II. Oct. 3, 1901. S. KUSANO; II. Sept. 26, 1896. S. HORI).—Prov. Rikuchū: Shinjō (II. & III. Sept. 26, 1897. Y. TAKAHASHI).

Kiushū.—Prov. Higo: Kumamoto (II. May 1902. T. KAWAKAMI; II. & III. Oct. 19, 1906. K. YOSHINO).

On *Setaria viridis* Beauv.

Honshū.—Prov. Musashi: Tokyo (II. Sept. 29, 1896. S. HORI; II. Oct. 3, 1901. S. KUSANO).—Prov. Izu: Shūzenji (II. Nov. 1, 1900. N. NAMBU).

Distrib. Japan and India.

REMARKS. In 1903, DIETEL (7) for the first time described this species under the name of *Uredo Setariae italicae* from the specimens on *Setaria viridis* as well as on *Setaria italica* var. *germanica* sent to him from Prof. S. KUSANO, who had collected them in October 1901 in Tokyo.

In 1906, SYDOW and BUTLER (1) reported the same fungus from India as infecting *Setaria intermedia*, *S. italica*, *S. glauca* and *S. verticillata*.

Mr. K. YOSHINO (1) having found the teleutospores of the present species on *Setaria italica* var. *germanica* in 1906 at Kumamoto, described it and proposed to change the name of this species to *Uromyces Setariae italicae* (Diet.). He made the following remarks: "It seems to me, although it sometimes occurs abundantly in Kiushū, that damages caused by this fungus are not so severe, because its appearance is always late in season in the ripening period of the host-plant."

The reasons why we have difficulty in finding the teleutostage specimens of the present species may probably be due to the rarity of the teleutostage or to the inconspicuousness of its sori.

b. Teleutosori naked.

5. *Uromyces Muehlenbergiae* S. Ito n. sp.—(Pl. X. Fig. 5.)

Teleutosori, hypophyllous, very rarely epiphyllous; small, oblong or linear, scattered or gregarious, often confluent, naked, pulvinate, compact, prominent, blackish-brown. Uredospores frequently mixed in the sori.

Uredospores, globose, subglobose or ellipsoidal, minutely echinulate, $17-24 \times 16-24 \mu$; epispore brownish yellow, $2-3$ or 4μ thick; germ-pores 3 or 4.

Teleutospores, subglobose, oval or oblong, apex rounded, angular or apiculate, thickened ($6-13 \mu$), base rounded, smooth, chestnut-brown, darker colored at apex, $18-28 \times 12-21 \mu$, rarely 32μ in length; epispore rather thick; pedicels brownish colored, persistent, $10-42 \mu$, sometimes 60μ ; paraphyses absent.

Hab. On *Muehlenbergia japonica* Steud.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 1890. K. MIYABE).—Prov. Shōribeshi: Zenibako (III. Oct. 9, 1895. K. MIYABE).

Distrib. Japan.

REMARKS. The only species of *Uromyces* known to grow on *Muehlenbergia* is *U. minimus* Davis in North America. To that species, our plant is closely related, but there are some points of difference between them, that would warrant us to consider them as distinct species. The characteristic by which our species can easily be recognized from the American, is the entire absence of paraphyses in the teleutosorus of our plant.

PUCCINIA Pers.

A. Teleutospores provided with coronate apex.

1. ***Puccinia coronata*** Cda., Icon. Fung., 1, 1837, (6); Winter, Pilze, 1, 1884, (218); Sacc., Syll., 7, 1888, (623); Schroeter, Pilz Schles., 1889, (323); Plowr., Brit. Ured. and Ustil., 1889, (163); Kleb., Zeits. f. Pflanzenk., 2, 1892, (337); 4, 1894, (131); 5, 1895, (151), (327); 6, 1896, (331); 8, 1898, (26); Eriks. et Henn., Die Getreideroste, 1896, (240); P. Henn., in Engl., Bot. Jahrb., 31, 1902, (732); Sydow, Monogr. Ured., 1, 1904, (699); Fischer, Ured. Schw., 1904, (373); Dietel, in Engl., Bot. Jahrb., 37, 1905, (100); in Ann. Mycol., 5, 1907, (73).—(Pl. X. Fig. 13.)

Hab. On *Calamagrostis arundinacea* Roth. var. *sciuroides* Hack.

Honshū.—Prov. Musashi: Ōmiya (III. Nov. 20, 1899. T. NISHIDA); Kobotoke (II. & III. Oct. 16, 1906. N. NAMBU).

Kiushū.—Prov. Higo: Sannō-dake (III. Oct. 8, 1905. K. YOSHINO).

On *Calamagrostis robusta* Fr. et Sav.

Honshū.—Prov. Musashi: Tokyo (III. Nov. 1, 1904. M. SHIRAI; III. Oct. 25, 1904. S. KUSANO).

Distrib. Europe, North America, Asia and Australia.

REMARKS. In 1892, KLEBAHN (1) remarked on the presence of two kinds of coronate *Puccinia*; which had generally been regarded as a single species under the name of *Puccinia coronata*. They are *Puccinia coronata* and *P. coronifera* (2) (= *P. Lolii* Niels.). The former species is related to the *Æcidium* on *Rhamnus Frangula* and the latter to the *Æcidium* on *R. cathartica*. ERIKSSON and KLEBAHN by a long series of careful experiments proved the presence of many specialized forms in both of these species.

In our country, there are many species of coronate *Puccinia*; but only those of *Calamagrostis arundinacea* var. *sciuroides* and *C. robusta*, although

little longer spores are sometimes found intermixed, coincide with the descriptions and European specimens of *P. coronata*.

2. *Puccinia Lolii* Niels., Ugeskrift for Landwaend., **9**, 1875, (549); Magnus, Oesterr. Bot. Zeitschr., **51**, 1901, (89); Sydow, Monogr. Ured., **1**, 1904, (704); McAlpine, The Rusts of Australia, 1906, (123).

Syn. : *Puccinia coronifera* Kleb., in Zeitschr. f. Pflanzenk., **3**, 1893, (199); **4**, 1894, (132); **5**, 1895, (151, 327); **6**, 1896, (331); Sacc., syll., **11**, 1895, (203); Eriksson, in Centralbl. f. Bact. &c. II., **3**, 1897, (302); Fischer, Ured. Schw., 1904, (375); Takahashi, in Trans. Sap. Nat. Hist. Soc., **1**, 1906, (46).

Hab. On *Avena sativa* L.

Hokkaidō.—Prov. Ishikari : Sapporo (II. Oct. 4, 1892. K. MIYABE; II. Sept. 12, 1903; II. June 17, 1903. T. MIYAKE); Tsuishikari (II. Sept. 29, 1907; II. Sept. 27, 1908. S. ITŌ); Ebetsu (II. Sept. 29, 1907. S. ITŌ); Shiroishi (II. & III. Oct. 6, 1908. S. ITŌ).

Honshū.—Prov. Rikuchū : Morioka (II. Sept. 1906. B. FUKUTA).—Prov. Echizen : Fukui (II. Aug. 1907. A. IGETA).

Kiushū.—Prov. Iigo : Kumamoto (III. July 13, 1904. K. YOSHINO); Aso (II. & III. Aug. 1901. T. KAWAKAMI).

On *Avena fatua* L.

Honshū.—Prov. Musashi : Shinagawa (II. May 27, 1903. K. MIYABE).

On *Avena sterilis* L.

Hokkaidō.—Prov. Ishikari : Sapporo (II. Oct. 1907. S. ITŌ).

Distrib. Europe, North America, Asia and Australia.

REMARKS. In 1892, KLEBAHN (1) proving its relation to the *Æcidium* on *Rhamnus cathartica* L. separated the present species from the old *Puccinia coronata* Cda., under the name of *Puccinia coronifera* (2). But NIELSEN (1) in 1875 had already found a similar relation existing between the *Æcidium* on *Rhamnus cathartica* and the coronate *Puccinia* on *Lolium perenne* and he gave it the name of *Puccinia Lolii*, which should be adopted on account of its priority.

ERIKSSON and KLEBAHN recorded six specialized forms to this species, and among them *f. sp. Avenæ* only has been found in our country. The uredospore-stage is common in our country, but the teleutospore-stage seldom occurs. Last fall I found the teleutostage on oats in the vicinity of Sapporo,

which I think is the first collection made in Hokkaidō. MCALPINE (1) remarked, that the teleutospores of this species on *Avena fatua* in Australia are longer than those on *Avena sativa*, reaching 86μ in length. In our country, I have not been able to find any teleutospore on the former host-plant, although the uredospore-stage is found. On examining our specimens on *Avena sativa*, however, I noticed the dimension of the teleutospore is slightly longer than that of Europe, the maximum length reaching 72μ in ours, while in European forms only 60μ . In other respects, they thoroughly coincide with each other.

The æcidial stage of this species as well as of *Puccinia coronata* is not yet found in Japan.

3. *Puccinia himalensis* (Barcl.) Diet., in Engl. u. Plantl, Naturl. Pflanzenfam., **1**, Th.** 1900, (63); Sydow, Monogr. Ured., **1**, 1904, (738); Sacc., Syll., **17**, 1905, (386); Dietel, in Engl., Bot. Jahrb., **37**, 1905, (100); in Ann. Mycol., **6**, 1908, (223).

Syn.: *Puccinia coronata* Cda. var. *himalensis* Barcl., in Trans. Lin. Soc., **3**, 1891, (229).

Hab. On *Brachypodium silvaticum* Beauv.

Honshū.—Prov. Izu: Irōzaki (III. June 2, 1904. S. KUSANO).

On *Brachypodium japonicum* Miq.

Honshū.—Prov. Mutsu: Hirosaki (III. Nov. 1896. N. HIRATSUKA).—Prov. Rikuchū: Morioka (III. Nov. 3, 1905. G. YAMADA).

Distrib. Japan and India.

REMARKS. DIETEL (2) elevated the BARCLEY'S var. *himalensis* of *Puccinia coronata* to a distinct specific rank on account of the smaller size of æcidiospores ($13-16 \times 10-15\mu$) and of naked teleutosori.

In Japan, Prof. S. KUSANO collected this species for the first time on *Brachypodium silvaticum* in Prov. Izu, and DIETEL identified it with the Himalayan species. In the present paper a new host-plant, *Brachypodium japonicum*, is added to the fungus.

An *Æcidium* on *Rhamnus japonicus*, sent to DIETEL from our country was considered by him as a stage of *Puccinia himalensis* (7). But afterwards another *Æcidium* on *Rhamnus japonicus* was reported by the same

author (8) as a distinct species on account of the dense aggregation of *Æcidia* in a larger group, and of the larger size of aecidiospores. He named it *Æcidium Rhamni japonici*. Infection experiment ought to be performed in order to settle the question, whether the *Æcidium* on *Rhamnus japonicus* has a genetic relation to *Puccinia himalensis* or not.

At Jōzankei, near Sapporo, Mr. KASAI collected a coronate Puccinia on the leaves of certain grass which does not belong to *Brachypodium*. The general character of its teleutospore coincides morphologically to those of the present species.

4. *Puccinia Diarrhenæ* Miyabe et Itō. n. sp.—(Pl. X. Fig. 6.)

Teleutosori, epiphyllous; minute or medium sized, oblong or round, scattered or gregarious, sometimes confluent, loosely covered by epidermis, soon after naked with the torn remains, somewhat pulvinate, compact, sooty black. Uredospores are sometimes found intermixed in the sori.

Uredospores, obovate, subglobose or globose, verrucoso-echinulate, light brownish yellow or hyaline, $20-26.5 \times 16-23.5\mu$; epispore thin ($1-2\mu$).

Teleutospores, oblong-clavate, ellipsoidal or fusiform, apex slightly thickened, with numerous blunt, rather short horn-like ($6-17\mu$ in length) or wart-like processes, base mostly attenuated, not or slightly constricted at the septum, smooth, ferruginous at the apex, lighter colored toward the base, $25-52 \times 10-21.5\mu$; epispore rather thin; pedicels hyaline or light yellowish at the upper portion, as long as the spore in length, persistent.

Hab. On *Diarrhena japonica* Fr. et Sav.

Honshū.—Prov. Rikuchū: Morioka (III. Oct. 21, 1906. G. YAMADA).—Prov. Uzen: Minamura (III. Aug. 25, 1903. Y. TAKAHASHI).

Distrib. Japan.

REMARKS. The occurrence of Puccinia on *Diarrhena* seems never to have been recorded so far. In our country, the present host-plant, *Diarrhena japonica* Fr. et Sav. is widely distributed though not common. The specimens of the fungus we have examined are only two in number, and in both of them the uredosori could not be found. Only a few of the uredospores we have observed were intermixed with the teleutospores. Among many coronate species of Puccinia on Gramineæ there are none provided with

such a long pedicel as in this species. *Puccinia Festucae* Plowr., it is true, has a long pedicel ($15-25\mu$ in length), but it is just about half the length of the pedicel of the species under consideration. Moreover, these two species differ from each other in so many points, that there is no need of questioning their identity.

5. *Puccinia brevicornis* S. Itō. n. sp.—(Pl. X. Fig. 7.)

Uredosori, amphigenous, mostly hypophyllous; small, oblong, or sub-linear, on the yellowish discolored spots, gregarious, scattered or somewhat arranged in lines, rarely confluent, naked, with the ruptured epidermis, pulverulent, orange-colored. Uredospores ellipsoidal, globose or obovate, echinulate, $14-21 \times 12-16\mu$; epispore comparatively thick; hyaline or somewhat yellowish; paraphyses sometimes present, few in number, hyaline, clavate or capitate, apex not thickened.

Teleutosori, hypophyllous, rarely epiphyllous; small, oblong or sub-linear, densely scattered, often confluent, loosely covered by epidermis or naked with the ruptured remains, pulvinate, compact, conspicuous, black. Teleutospores cylindrical, oblong-clavate, thickened ($6-8\mu$) at apex, truncate, with the tubercular, short blunt horn-like processes or slightly undulate, base attenuated, not or slightly constricted at the septum, smooth, chestnut-brown, darker at apex, $40-74 \times 12-24\mu$; epispore rather thin; pedicels very short, brown, persistent.

Hab. On *Calamagrostis villosa* Mut.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 1894.; III. Oct. 18, 1897. K. MIYABE; III. Oct. 28, 1895. Y. TOKUBUCHI; II. & III. March 2, 1896. J. TOCHINAI; II. July 20, 1907; III. Oct. 4, 1907. S. ITŌ); Tsuishikari (II. & III. Sept. 21, 1902. G. YAMADA; II. & III. Oct. 1, 1905; III. Sept. 29, 1907. S. ITŌ; III. Oct. 6, 1907. M. KASAI); Okatama (III. Oct. 17, 1903. T. MIYAKE); Kamuikotan (II. & III. Oct. 9, 1907. S. ITŌ); Chikabumi (II. July 10, 1905. T. MIYAKE).

On *Calamagrostis canadensis* Beauv.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Nov. 5, 1897. K. MIYABE).

Distrib. Japan.

REMARKS. The present fungus seems to be restricted to *Calamagrostis villosa* Mut., which is quite common in Hokkaidō. It is also found on *Calamagrostis canadensis* cultivated in the College Botanical Garden, but not on other species of the genus. Very short processes at the tip of the teleuto-

spores are the characteristic by which this species can easily be distinguished from other coronate species of *Puccinia*.

6. *Puccinia Epigejos* S. Itō n. sp.—(Pl. X. Fig. 8.)

Uredosori, epiphyllous, sometimes hypophyllous; minute, oblong or linear, scattered or gregarious, on discolored spots, sometimes confluent, loosely covered by the epidermis, or naked, with ruptured remains, pulverulent, orange-colored. Uredospores ellipsoidal, oval or globose, echinulate, $24-36 \times 20-26\mu$; episore thin, yellowish brown or hyaline; paraphyses numerous, capitate or clavate, hyaline or subhyaline, apex not thickened.

Teleutosori, epiphyllous, rarely hypophyllous in severe cases, or on the sheath; small, oblong or linear, scattered or gregarious, often confluent, reaching on the leaves 4 mm. in length, on the sheath 1.5 cm. long, naked, with ruptured epidermis, pulvinate, compact, conspicuous, black. Teleutospores cylindrical, long-clavate, apex thickened ($4-6\mu$), with the blunt, horn-like processes, base attenuated, not or slightly constricted at the septum, smooth, ferruginous or chestnut-brown, darker at apex, $36-92 \times 14-20\mu$; episore thin; pedicels very short, brown, persistent.

Hab. On *Calamagrostis Epigejos* Roth. var. *densiflora* Led.

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Oct. 19, 1894; II. & III. Oct. 10, 1895. N. HIRATSUKA; II. & III. Oct. 16, 1907. S. ITŌ); Shiroishi (II. Aug. 8, 1895. N. HIRATSUKA); Asahigawa (III. Oct. 8, 1907. S. ITŌ) **Nagayama (III. Oct. 7, 1907. S. ITŌ); Garugawa (II. & III. Sept. 22, 1907. S. ITŌ).—Prov. Shiribeshi: Zenibako (II. Aug. 6, 1895; II. Aug. 2, 1899. K. MIYABE).

Distrib. Japan.

REMARKS. This fungus is found everywhere in Hokkaidō, where *Calamagrostis Epigejos* Roth. var. *densiflora* Led. grows abundantly.

Naked teleutosori are commonly epiphyllous. The teleutospores are longer and larger compared with those of *Puccinia coronata*. Especially the uredospores are the largest among the coronate species of *Puccinia*. ERIKSSON recorded *Puccinia coronata* as occurring on the present host-plant. His descriptions in regard to the measurement of the uredospore and the teleutospore do not coincide with those of our present species, which I have consequently treated here as a new species.

7. *Puccinia pertenuis* S. Itō n. sp.—(Pl. X. Fig. 9.)

Teleutosori, hypophyllous, rarely epiphyllous; minute, oblong or linear, densely scattered over the discolored portion, sometimes confluent, naked or loosely covered by the epidermis, pulvinate, compact, conspicuous, black. Uredospores mixed in the sori.

Uredospores ellipsoidal to globose, echinulate, $16-24 \times 16-18\mu$; episporium thin, light yellowish; paraphyses short, obovate-clavate, light brownish-colored, apex not thickened, $30-55 \times 20-26\mu$.

Teleutospores cylindrical, linear or oblong clavate, apex thickened, coronate with numerous blunt somewhat long processes, base attenuated, scarcely constricted at the septum, ferruginous, darker at apex, $40-72 \times 10-16\mu$; episporium very thin; pedicels brown, short, subdeciduous.

Hab. On *Calamagrostis arundinacea* Roth. var. *nipponica* Hack.

Honshū.—Prov. Sagami: Hakone (II. J. MATSUMURA).

Distrib. Japan.

REMARKS. This species resembles *Puccinia coronata* in the position and macroscopical appearance of their teleutosori, but they can easily be distinguished from each other microscopically.

In the general form of the teleutospores, our plant resembles *Puccinia Epigejos*, from which it differs, however, in the position of its teleutosori and in the smaller size of its uredospores.

8. *Puccinia Hierochlæ* S. Itō n. sp.—(Pl. X. Figs. 10, 11.)

Uredosori, amphigenous, mostly epiphyllous, or on the sheath; small oblong or linear, densely or loosely scattered over the surface, often confluent, naked or loosely covered by the epidermis, pulverulent, orange-colored. Uredospores ellipsoidal to globose, echinulate, $16-26.5 \times 12-18\mu$; episporium comparatively thick, hyaline or yellowish; paraphyses sometimes present, clavate or capitate, hyaline, apex not thickened, $50-72 \times 10-15\mu$.

Teleutosori, amphigenous, mostly epiphyllous or on the sheath; small or medium in size, oblong or linear, scattered or gregarious, often confluent (2-4 mm.), loosely covered by the epidermis, becoming soon naked with ruptured remains, pulvinate, compact, conspicuous, black. Teleutospores cylindrical, oblong-clavate or linear-clavate, apex thickened, with the nu-

merous blunt, rather long processes, generally more or less divergent, base attenuated, not or slightly constricted at the septum, smooth, ferruginous or light chestnut-brown, $30-80 \times 14-22\mu$, rarely 104μ in length; epispore thin; pedicels very short, brown, subdeciduous.

Hab. On *Hierochloë borealis* Roem.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 1894; III. Oct. 23, 1896; III. Oct. 10, 1899. K. MIYABE; III. Sept. 15, 1899. G. YAMADA); Tsukisappu (III. June 1896. K. MIYABE; III. May 15, 1903. S. ITŌ); Ishikari (II. & III. Sept. 24, 1899. G. YAMADA); Kamikawa (III. Oct. 1, 1899. T. KAWAKAMI); Kamuikotan (III. Oct. 8, 1906. K. MIURA); Tsuishikari (II. & III. Sept. 29, 1907. S. ITŌ).—Prov. Shiribeshi: Esashi-Gorinzawa (II. Aug. 10, 1902. G. YAMADA).—Prov. Iburi: Numanohata (III. Nov. 1, 1900. K. MIYABE & G. YAMADA).

Honshū.—Prov. Mutsu: Goshogawara (III. Oct. 1904. T. KASHIWA).

On *Stipa sibirica* Lam.?

Honshū.—Prov. Rikuchū: Morioka (III. Oct. 29, 1905. G. YAMADA).

Distrib. Japan.

REMARKS. SYDOW (1) notices the presence of a species of coronate *Puccinia* on *Hierochloë* sp. in Europe without giving any description. Our fungus may be identical with the European species. The present species can easily be distinguished from common *Puccinia coronata* by the epiphyllous position and larger size of its teleutosori. The general appearance of the teleutospore resembles that of *Puccinia Epigejos*, but it differs in its longer and more or less divergent processes at the apex. Moreover, the uredospore of the present species is in general smaller in size than that of the species just referred to.

The length of the lower cell of its teleutospore is very variable, some reaching even 70μ , which is in fact longer than the largest teleutospores in *Puccinia coronata*. A similar fungus is found on *Stipa sibirica*? collected at Morioka by Prof. G. YAMADA, and I have placed it in the present species.

9. *Puccinia rangiferina* S. Itō n. sp.—(Pl. X. Fig. 12.)

Teleutosori, hypophyllous or on the sheath; small or medium in size, oblong or linear, scattered or gregarious, often confluent, naked, with the ruptured epidermis, pulvinate, compact, conspicuous, black. Teleutospores cylindrical or oblong-clavate, apex thickened, with 2-9 long, sometimes branching, divergent processes (maxim. about 31μ), base attenuated, not or

slightly constricted at the septum, smooth, ferruginous, darker at apex, $24-102 \times 11-21 \mu$; epispore thin; pedicels very short, subdeciduous.

Hab. On *Calamagrostis arundinacea* Roth. var. *sciuroides* Hack.

Honshū.—Prov. Rikuchū: Morioka (III. Oct. 29, 1905. G. YAMADA).

Distrib. Japan.

REMARKS. The teleutospores of the present species are provided with remarkably long and elegant processes at the apex, and we can easily distinguish it from other related species.

B. Teleutospores not provided with coronate apex.

a. Teleutosori covered by the epidermis.

a. Paraphyses absent in uredosori.

10. Puccinia glumarum (Schmidt) Eriks. et Henn. in Zeits. f. Pflanzenk. **4**, 1894 (197); Die Getreideroste, 1896, (141); Henn., Engl., Bot. Jahrb., **31**, 1902, (731); Sydow, Monogr. Ured., **1**, 1904, (706); Fischer, Ured. Schw., 1904, (366); Sacc., Syll., **17**, 1905, (380); Takahashi, in Trans. Sap. Nat. Hist. Soc., **1**, 1906, (39); Butler and Hayman, in Mem. of the Depart. of Agric. in India, **1**, 1906, (28).

Hab. On *Hordeum sativum* Jess.

Hokkaidō.—Prov. Ishikari: Sapporo (II. June 20, 1900. S. YŪKI; II. July 24, 1900. G. YAMADA; II. July 1, 1904. T. MIYAKE; II. & III. Sept. 14, 1905. K. MIYABE & J. HANZAWA); Tsuishikari (II. July 1895. K. MIYABE); Bebetsu (III. July 22, 1905. T. MIYAKE).—Prov. Oshima: Higashi-ozakimura (III. July 13, 1902. T. MIYABE).

Honshū.—Prov. Musashi: Mejiro (II. & III. July 14, 1907. N. NAMBU).

Kiushū.—Prov. Higo: Kumamoto (II. July 1903. K. YOSHINO); Imizu-mura (II. Jan. 23, 1906. K. YOSHINO).

On *Hordeum sativum* Jess. (*Hadaka-mugi*).

Hokkaidō.—Prov. Ishikari: Sapporo (III. July 31, 1903. Y. TAKAHASHI).—Prov. Teshio: Utatoshibetsu (III. July 22, 1903. Y. TAKAHASHI); Mashike (II. July 20, 1903. Y. TAKAHASHI).

Kiushū.—Prov. Higo: Imizu-mura (II. Nov. 9, 1906. K. YOSHINO).

On *Triticum vulgare* Vill.

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Aug. 12, 1895. N. HIRATSUKA; II. & III. July 24, 1900. G. YAMADA; II. July 6, 1901. T. MIYAKE; II. July 6, 1904; III. July 30, 1903. Y. TAKAHASHI; III. July 20, 1904. T. MIYAKE; II. July 12, 1907; III. Oct. 12, 1907. S. ITŌ); Asahigawa (II. Oct. 8, 1907. S. ITŌ); Bebetsu (III. July 22, 1905. T. MIYAKE).

Honshū.—Prov. Musashi: Tokyo (II. & III. June 4, 1899. S. KUSANO); Meguro (II. May 18,

1902. N. NAMBU).—Prov. Rikuchū: Morioka (II. July 21, 1907. G. YAMADA); Kuzumaki (II. & III. July 6, 1907. M. MIURA).—Prov. Kōzuke: Ōda (II. June 5, 1906. G. MATSUMURA).—Prov. Echigo: Fukuto-mura (II. June 1903. K. YOSHINO).—Prov. Echizen: Fukui (II. 1907. A. IDETA).—Prov. Settsu: Ōsaka (III. 1906. A. IDETA).

Kiushū.—Prov. Higo: Kumamoto (III. June 1907. T. TADA); Jinnai-mura (III. May 20, 1905. K. YOSHINO); Kuhonji-mura (II. May 1, 1905. K. YOSHINO).

Shikoku.—Prov. Iyo: Kuwahara (II. June 1900. K. OKUDAIRA); Sugō-mura (II. June 10, 1899. K. OKUDAIRA).

On *Triticum monococcum* L. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo Bot. Gard. (III. Sept. 1902. T. MIYAKE).

Distrib. Europe, North America, Asia and Africa.

REMARKS. The yellow rust, as this fungus is now generally known, occurs more frequently on wheat than on barley in several parts of Japan. This species can easily be distinguished macroscopically from other rust fungi on cereals by the yellowish discolored streaks of the uredosori on the leaves and also by the streak-dotted arrangement of the teleutosori on the sheath.

This species was at first included with other species in *Puccinia rubigo-vera* DC. (*P. striæformis* West., *P. straminis* Fuck.). In 1894, ERIKSSON and HENNING (1) divided *Puccinia rubigo-vera* into two species, viz., *P. glumarum* (Schmidt.) and *P. dispersa* by their morphological characters. In 1899, ERIKSSON (4) divided old *P. rubigo-vera* still further into the following eight species:—

1. *Puccinia glumarum* (Schmidt.) Eriks. et Henn.
The yellow rust (*Æcidium* unknown).
2. *P. dispersa* Eriks. (not Eriks. et Henn.)
The brown rust of rye (*Æcidium* on *Anchusa*).
3. *P. triticina* Eriks.
The brown rust of wheat (*Æcidium* unknown).
4. *P. Symphyti-Bromorum* Müll. (= *P. bromina* Eriks.)
The brown rust of bromes (*Æcidium* on *Symphytum*).
5. *P. agropyrina* Eriks.
On *Triticum repens* (*Æcidium* unknown).
6. *P. holcina* Eriks.
On *Holcus lanatus*, *H. mollis* (*Æcidium* unknown).

7. *P. Triseti* Eriks.

On *Trisetum flavescens* (*Æcidium* unknown).

8. *P. simplex* (Kcke) Eriks. et Henn.

The dwarf rust of barley (*Æcidium* unknown).

No. 1, 2, 3, 4 and 8 are found in our country.

Further, ERIKSSON subdivided *Puccinia glumarum* into the five following specialized forms :—

1. *f. sp. Tritici*.

2. *f. sp. Hordei*.

3. *f. sp. Secalis*.

4. *f. sp. Elymi*.

5. *f. sp. Agropyri*.

In Japan, the first two forms only have been found so far.

11. *Puccinia dispersa* Eriks. in Ann. d. Sc. nat. 8 s, 9, 1899, (241); Fischer, Ured, Schw., 1904, (357); Takahashi, in Trans. Sap. Nat. Hist. Soc., 1, 1906, (44).

Hab. On *Secale cereale* L.

Hokkaidō.—Prov. Ishikari: Sapporo (II. June 28, 1895. Y. TOKUBUCHI; II. Aug. 1, 1895. K. MIYABE; II. Sept. 16, 1897. T. NISHIDA; II. July 24, 1900. G. YAMADA; II. & III. Aug. 24, 1904. Y. TAKAHASHI; II. July 12, 1907. S. ITŌ).

Honshū.—Prov. Rikuchū: Morioka (II. May 1906. B. FUKUTA); Osawa (II. July 12, 1907. G. YAMADA.)

Distrib. Europe, Asia minor, Siberia, Japan and North America.

REMARKS. As was remarked in the case of *Puccinia glumarum*, this species was formerly included in *Puccinia rubigo-vera*, from which ERIKSSON (1) had separated it as a distinct species. By infection experiments, he has divided it into the four following specialized forms :—

1. *f. sp. Secalis*.

2. *f. sp. Tritici*.

3. *f. sp. Bromi*.

4. *f. sp. Agropyri*.

Five years later, ERIKSSON (4) elevated the *f. sp. Secalis* into a specific rank and gave to it the name *Puccinia dispersa* Eriks. (not Eriks. et

Henn.). Three other specialized forms also have been given independent specific positions to which I shall refer later on.

The aecidial stage of the species under consideration is known to occur on *Anchusa arvensis* and *A. officinalis* in Europe. As there are no species of *Anchusa* in our flora, the aecidial stage may have been altogether abbreviated in our country. *Anchusa officinalis* is cultivated on our College farm, but we have not yet found any *Æcidium* growing upon it.

The specimens of *Puccinia dispersa* which I have examined are rather scanty in number, as rye is not yet widely cultivated in our country. I have specimens only from Sapporo and Morioka. In the vicinity of Sapporo, rye is annually attacked rather severely by the uredospores of this fungus. Its teleutospores, however, are seldom found.

12. *Puccinia triticina* Eriks, in Ann. d. Sc. nat., 8 s, 9, 1899, (270); Sydow, Monogr. Ured., 1, 1904, (716); Fischer, Ured. Schw., 1904, (366); Sacc., Syll., 17, 1905, (376); Butler and Hayman, Mem. Depart. Agric. India, 1, 1906, (30); Takahashi, Trans. Sap. Nat. Hist. Soc. 1, 1906, (42).

Hab. On *Triticum vulgare* Vill.

Hokkaidō.—Prov. Ishikari: Sapporo (III. July 21, 1892. T. NAKANO; II. June 28, 1895, Y. TOKUBUCHI; III. Aug. 1, 1895. K. MIYABE; II. & III. July 20, 1900. S. YŪKI; II. & III. July 24, 1900. G. YAMADA; III. July 27, 1901; III. Aug. 1904; II. & III. Aug. 25, 1904. Y. TAKAHASHI; II. July 12, 1907; II. Aug. 25, 1907. S. ITŌ); Kamikawa (II. Oct. 1, 1899. T. KAWAKAMI); Yamahana (II. July 31, 1900. K. MIYABE); Nagayama (II. Aug. 25, 1903. K. MIYABE); Tsuishikari (II. Sept. 29, 1907. S. ITŌ).—Prov. Shiribeshi: Hassoku-mura (III. July 28, 1897. G. YAMADA).

Honshū.—Prov. Rikuchū: Morioka (II. & III. July 14, 1907. G. YAMADA).—Prov. Musashi: Tokyo (II. & III. June 4, 1899. KUSANO); Hachiōji (II. June 11, 1898. S. KUSANO); Nishigahara (III. June 7, 1902. K. YOSHINO).—Prov. Echigo: Teradomari (II. April 13, 1903. K. YOSHINO); Nagaoka (II. May 8, 1903. K. YOSHINO); Tsubame (II. & III. July 29, 1908. S. ITŌ).—Prov. Echizen: Fukui (II. & III. June 1907. A. IGETA).—Prov. Mino: Tomokata-mura (II. & III. May 28, 1899. YAMAGUCHI); Kamiida-mura (II. May 22, 1899. YAMAGUCHI).—Prov. Settsu: Ōsaka (III. 1906. A. IGETA).

Kiushū.—Prov. Higo: Kumamoto (III. March 2, 1905; III. May 25, 1906. K. YOSHINO); Imizu-mura (II. March 2, 1905; III. May 8, 1906. K. YOSHINO); Kurokami-mura (III. June 2, 1907. T. TADA).

Distrib. Europe, India, Japan and North America.

REMARKS. The *f. sp. Tritici* of *Puccinia dispersa* Eriks. et Henn. was elevated to a distinct species by ERIKSSON (4) after careful investigations. Its aecidial stage is not yet found.

In Hokkaidō, this fungus occurs abundantly on wheat, causing great damage. It is often found mixed with *Puccinia glumarum*, from which it can easily be distinguished by the scattered brownish uredosori, and also by the light brownish membrane of the uredosopore. Moreover, the teleutosori of *Puccinia glumarum* are arranged in serial dots on the sheath, while those of *Puccinia triticina* are irregularly scattered; and also the teleutospores of *Puccinia triticina* are generally not so long and unsymmetrical as those of *Puccinia glumarum*.

These distinguishing characters can readily be observed in fresh materials, but in dried specimens it is somewhat difficult to distinguish them from each other by the color of the uredosori, as the color is liable to fade when dried. Also the streaked nature of the teleutosori in *Puccinia glumarum* often becomes indistinguishable when severely attacked, and moreover, *Puccinia triticina* may rarely show the serial sori on the sheath. Consequently, when a dried specimen is to be examined, great care is needed to distinguish these two species.

13. *Puccinia Symphyti-Bromorum* Fr. Müll., in Beihefte Bot. Centralb., **10**, 1901, (201); Fischer, Ured. Schw., 1904, (359).

Syn.: *Puccinia bromina* Eriks. in Ann. d. Sc. nat., 8 s, **9**, 1899, (271); Sydow, Monogr. Ured., **1**, 1904, (712); Sacc., Syll., **17**, 1905, (382); McAlpine, Rusts of Australia, 1906, (116).

Hab. On *Bromus pauciflorus* Hack.

Honshū.—Prov. Rikuchū: Morioka (II. & III. Oct. 20, 1907. K. OKUMURA).

Distrib. Europe, Asia minor, Japan and Australia.

REMARKS. At first ERIKSSON (1) considered this species as a specialized form of *Puccinia dispersa* Eriks. et Henn. Later he regarded it as a distinct species and named it *Puccinia bromina* Eriks. (4). In 1901, Fr. MÜLLER (1) found the aecidial stage of the fungus by infection experiments and gave it the name which I have adopted in this paper. Its presence in Japan has not been known to us hitherto. A specimen, collected by Mr. OKUMURA, and sent to me through the kindness of Prof. G. YAMADA, agrees in nearly all of its characteristics to the present species.

The aecidial stage of this fungus is not yet found in our country.

14. *Puccinia simplex* (Koern.) Eriks. et Henn. in Zeits. f. Pflanzenk., 4, 1894, (259); Die Getreideroste, 1896, (238); Sydow, Monogr. Ured., 1, 1904, (756); Fischer, Ured. Schw., 1904, (368); Sacc., Syll., 17, 1905, (377);, McAlpine, Rusts of Australia, 1906, (130); Takahashi, Trans. Sap. Nat. Hist. Soc., 1, 1906, (43).

Hab. On *Hordeum sativum* Jess.

Hokkaidō.—Prov. Ishikari: Sapporo (II. Aug. 1895. K. MIYABE; II. July 28, 1901. J. HANZAWA; III. Aug. 1, 1904. Y. TAKAHASHI); Kotoni-mura (II. July 13, 1894. K. MIYABE); Osarappe (II. Oct. 6, 1905. T. MIYAKE).—Prov. Shiribeshi: Okushiri (II. July 27, 1890. K. MIYABE).

Honshū.—Prov. Rikuchū: Morioka (III. May 1906. B. FUKUTA; June 23, 1907; July 14, 1907. G. YAMADA); Kuzumaki (II. & III. July 6, 1907. M. MIURA).—Prov. Uzen: Yamagata (III. Nov. 10, 1907. S. MURAYAMA).—Prov. Musashi: Tokyo (II. May 14, 1902. K. YOSHINO).—Prov. Echizen: Fukui (III. June 1907. A. IGETA).

Shikoku.—Prov. Iyo: Sugō-mura (II. May 22, 1899; June 10, 1899. K. OKUDAIRA).

Kiushū.—Prov. Higo: Kumamoto (III. April 28, 1905. S. MAIHARA; II. & III. May 28, 1906. K. YOSHINO); Imizu-mura (II. May 25, 1905; II. June 1905. K. YOSHINO); Sunatori-mura (II. May 26, 1906. K. YOSHINO).

On *Hordeum sativum* Jess. (*Hadaka-mugi*)

Hokkaidō.—Prov. Kushiro: Riruran (II. July 27, 1904. Y. TAKAHASHI).

Honshū.—Prov. Sagami: Nagai-mura (II. May 4, 1904. K. MIYABE).—Prov. Echizen: Fukui (II. June 3, 1907. A. IGETA).

Kiushū.—Prov. Higo: Kumamoto (II. April 23, 1907. T. TADA); Imizu-mura (II. Nov. 9, 1906. K. YOSHINO); Sunatori-mura (III. June 1905. K. YOSHINO).

Distrib. Europe, Asia minor, Japan and Australia.

REMARKS. The "brown or dwarf rust of barley" occurs more frequently and causes greater damage than *Puccinia glumarum*. This species, by the frequent occurrence of the single celled teleutospores and by the smaller uredosori, is easily distinguishable from other species parasitic on cereals.

This species was regarded as *Puccinia straminis* Fuck. var. *simplex* by KOERNICKE in 1865. In 1875, it was named as *Uromyces Hordei* Nielsen, and in 1876 as *Puccinia anomala* Rostrup. In 1894, ERIKSSON and HENNING (1) regarded it also as an independent species and gave it the present name.

15. *Puccinia Glyceriæ* S. Itō. n. sp.—(Pl. XI. Fig. 2.)

Syn.: *Puccinia Paniculariæ* Diet. in Ann. Mycol., 6, 1908, (224).

Uredosori, amphigenous, mostly epiphyllous; minute, oblong or roundish, on the yellowish discolored portions, gregarious or scattered, sometimes confluent, loosely covered by epidermis, soon after ruptured, pulverulent, orange-colored. Uredospores globose, subglobose or broadly ellipsoidal, echinulate, light yellowish colored or hyaline, $20-28 \times 18-24 \mu$; paraphyses absent.

Teleutosori, hypophyllous; minute or medium sized, oblong or linear, gregarious, somewhat arranged in lines, sometimes confluent (rarely 1 cm. in length), almost always covered by the epidermis, pulvinate, compact, black- or grey-colored. Teleutospores subcylindrical or cylindrical, apex truncate or wavy, thickened ($5-6 \mu$, rarely 8μ), base tapering toward the pedicel, or angular, not or slightly constricted at the septum, smooth, yellowish brown-colored, $43-62 \times 12-20 \mu$; epispore thin; pedicels short, brown or subhyaline, subdeciduous.

Hab. On *Glyceria aquatica* Sm.

Hokkaidō.—Prov. Ishikari: Jōzankei (II. & III. Aug. 19, 1898. K. MIYABE; II. & III. Aug. 24, 1898. T. NISHIDA); Shiroishi (II. & III. Oct. 6, 1907. S. ITO); Teine (II. & III. Oct. 25, 1907. S. ITO).

On *Glyceria tonglensis* Clk.

Shikoku.—Prov. Tosa: Kōchi (III. Jan. 2, 1907. S. KUSANO); Kamoda-mura (II. & III. Oct. 1907. T. YOSHINAGA).

Kiushū.—Prov. Higo: Kurokawa-mura (II. & III. Aug. 13, 1906. K. YOSHINO).

Distrib. Japan.

REMARKS. This species resembles closely *Puccinia Paniculariæ* Arth (1), which is parasitic on *Panicularia americana* (= *Glyceria grandis*) in North America. *Glyceria aquatica* and *G. tonglensis* (= *G. caspia* Trin.) are not recorded as the host-plants to the American species. In 1908, DIETEL (12), examining the specimen on *Glyceria tonglensis* sent by Mr. YOSHINAGA, recorded it as the same as the American species. By comparing the type specimen which Mr. YOSHINAGA had kindly sent me and many others with the description of *Puccinia Paniculariæ* I came to conclusion, that the Japanese and American plants are of two distinct species.

The points of difference are as follows :—

1. No record of the uredosori in the American species, the uredospores being found mixed within the teleutosori, but in our species the independent

uredosori are generally found on the opposite surface of leaves to the teleutosori, in which the uredospores are not found mixed.

2. The germ-pores of the uredospore are six in the American species, while in our species they are inconspicuous and most probably four.

3. The dimension of our uredospore is a little larger than that of the American species.

4. The teleutosori are recorded to be amphigenous, while ours are exclusively hypophyllous.

5. The teleutospores in our species are subcylindrical or cylindrical, while the American are oblong-clavate or clavate, sometimes sublinear.

6. The apex of the teleutospore is $5-6\mu$ thick in ours, while it is not or slightly thickened in the American.

7. The length of the teleutospore in ours measures 62μ at its maximum, while 70μ in the American species.

These differences will, I believe, sufficiently support the establishment of a new species of rust fungi.

16. *Puccinia Elymi-sibiricæ* S. Itō. n. sp.—(Pl. XI. Fig. 1.)

Uredosori, amphigenous, mostly epiphyllous; minute, oblong, scattered or gregarious, sometimes arranged in lines, naked, with the ruptured epidermis, pulverulent, dark orange-colored. Uredospores, globose, subglobose or ovate, verrucoso-echinulate, $28-32 \times 20-22\mu$; brownish yellow-colored; germ-pores 4; paraphyses absent.

Teleutosori, hypophyllous; minute, oblong, densely scattered over the surface, always covered by epidermis, blackish. Teleutospores cuneiform, cylindrical or clavate, apex truncate obliquely pointed or rounded, thickened ($6-10\mu$), base attenuated, not or slightly constricted at the septum, smooth ferruginous, $36-70 \times 18-22\mu$; pedicels short, brown, subdeciduous. The sori are surrounded by a thick bed of brown paraphyses.

Hab. On *Elymus sibiricus* L.

Saghaien.—Nayashi (II & III. Aug. 12, 1906. K. MIYABE & T. MIYAGI).

Hokkaidō.—Prov. Shiribeshi: Okushiri (II. & III. July 27, 1890. K. MIYABE).

Distrib. Japan.

REMARKS. There are five species already recorded as parasitic on *Elymus*; namely, *Puccinia graminis*, *P. glumarum*, *P. montanensis*, *P. procrea* and *P. impatientis*. We need not discuss here differences of the present species and *P. graminis* and *P. montanensis*, because they differ from one another in many prominent points. *Puccinia glumarum*, *P. procrea* and *P. impatientis* are rather related to our species in the general shape of teleutospores. From *Puccinia glumarum*, it differs by having the uredospore, whose wall is brownish yellow in color, while it is hyaline or light yellow in *Puccinia glumarum*. From *P. procrea*, it differs in smaller uredospores, and teleutosori. In the former species, the uredospore is very large, and the teleutosorus is more remarkably so, measuring often 1 cm. in length, while in our species, the sorus is only 1.5–3 mm. in length. Moreover, the teleutospore of the former is larger than that of ours. From *P. impatientis* it differs in a fewer number of the germ-pores of uredospores and the teleutospore of this species is longer than that of others. As there are no species already described which correspond exactly with our species I may be justified in considering it as a new species.

17. *Puccinia sessilis* Schneid., in Schroeter, Brand und Rostpilze Schles. in Abhandl. d. Schles. Ges. naturw. Abt. 1869, (19); Winter, Pilze, 1884, (222); Schroeter, Pilz Schles., 1889, (324); Dietel, in Engl., Bot. Jahrb., **27**, 1900, (569); **32**, 1903, (48); **32**, 1903, (626); Henn., in Engl., Bot. Jahrb., **31**, 1902, (732); Sydow, Monogr. Ured., **1**, 1904, (781).

Hab. On *Phalaris arundinacea* L.

Saghalien.—Wendgishi (III. Aug. 18, 1906. K. MIYABE & T. MIYAGI); Makunkotan (III. Sept. 15, 1906. T. MIYAKE)

Hokkaidō.—Prov. Ishikari: Ebetsu (III. Sept. 29, 1907. S. ITŌ).

Honshū.—Prov. Tokyo (II. & III. Oct. 26, 1899; III. Sept. 2, 1900. S. KUSANO).

Kiushū.—Prov. Higo: Imizu-mura (II. May 15, 1904. S. YOSHINO).

Distrib. Europe, North America and Japan.

REMARKS. The present species was named by SCHNEIDER in 1891 but described by SCHROETER (1) in 1869. PLOWRIGHT, DIETEL and KLEBAHN have found in *Puccinia sessilis* many biological species by infection experiments; they are as follows:—

1. *Puccinia Ari-Phalaridis* (Plowr.) Kleb.
2. *P. Allii-Phalaridis* Kleb.

3. *P. Smilacearum-Digraphidis* Kleb.
4. *P. Paridi-Digraphidis* (Plowr.) Kleb.
5. *P. Schmidtiana* Diet.
6. *P. Convallariae-Digraphidis* (Sopp.) Kleb.
7. *P. Orchidearum-Phalaridis* Kleb.

In the absence of infection experiments, it is difficult to say to which of these seven biological species our plant belongs.

There are also in our country several aecidial forms on the same or related host-plants as those found in Europe, which have a relation with *Puccinia* on *Phalaris arundinacea*. They are *Æcidia* on *Convallaria Majalis*, *Majanthemum Convallaria*, *Polygonatum officinale*, *P. latifolium* var. *commutatum*, *P. humile*, *Paris quadrifolia* var. *obovata* and *Orchis aristata*. Besides these we have an *Æcidium* on *Trillium kamschaticum* which is pretty near in its systematic position to *Paris*.

Comparing our *Æcidia* above mentioned to the description of the European species, I can hardly find any morphological difference between them. From this fact one may be inclined to divide our "*Puccinia sessilis*" into four following species, that is, *Puccinia Convallariae-Digraphidis*, *P. Smilacearum-Digraphidis*, *P. Paridi-Digraphidis* and *P. Orchidearum-Phalaridis*. But the following factors made me hesitate to treat them in that way.

1. *Æcidium* on *Convallaria Majalis* was collected in Saghalien by Mr. T. MIYAKE. He has a specimen of *Puccinia* sp. parasitic on the same host-plant, although it was collected in quite a different locality in the same island.

2. *Æcidium* on *Majanthemum Convallaria* occurs comparatively abundantly in our country. *Puccinia Majanthemi* Diet., a species peculiar to Japan, grows also on the same host-plant, very rarely accompanied by the *Æcidium*.

3. There is no record of infection experiment with the *Æcidium* on *Polygonatum latifolium* var. *commutatum* and *P. humile*.

4. *Paris quadrifolia* var. *obovata* is found abundantly in Hokkaidō, yet the *Æcidium* is very rarely found on it. I have collected it only once at Kuriyama, Prov. Ishikari. And I have failed to find *Phalaris arundinacea* in that vicinity.

All these relations remain unsettled so long as the infection experiments are not carefully performed. Meanwhile, I am compelled to adopt the old collective name of *Puccinia sessilis* in this paper.

18. *Puccinia brachysora* Diet. in Engl., Bot. Jahrb., **32**, 1903, (49); Sydow, Monogr. Ured., **1**, 1904, (737); Sacc., Syll., **17**, 1905, (383); Dietel, in Ann. Mycol., **5**, 1907, (73); **6**, 1908, (224).—(Pl. XI. Fig. 3.)

Hab. On *Brachypodium japonicum* Miq.

Honshū.—Prov. Musashi: Tokyo (II. & III. July 15, 1899. S. KUSANO).

Shikoku.—Prov. Tosa: Jinzenji-mura (III. Sept. 1906. T. YOSHINAGA).

Kiushū.—Prov. Higo: Kumamoto (III. June 15, 1906. K. YOSHINO); Kawashiri-mura (III. June 10, 1906. K. YOSHINO).

Distrib. Japan.

REMARKS. DIETEL (6) regarded this species to be a new one remarking on the shortness of the teleutosori, on their arrangement in lines and on the larger size of the uredospore.

From the related species *Puccinia himalensis*, this fungus may easily be distinguished by the absence of a crown at the apex of its teleutospore. From *Puccinia culmicola*, it is distinguished at once by the naked sori of the former.

DIETEL (6) describes the uredosori as hypophyllous, and the teleutosori as epiphyllous; but by examining the same type specimen, I observed that uredosori are epiphyllous and the teleutosori are hypophyllous.

19. *Puccinia Bromi-japonicae* S. Ito. n. sp.—(Pl. XI. Fig. 4.)

Uredosori, epiphyllous; minute, oblong or linear, scattered or gregarious, often confluent, yellowish brown. Uredospores globose, subglobose or ellipsoidal, densely echinulate, yellowish, $22-30 \times 18-25 \mu$; epispore thin; germ-pores numerous, inconspicuous; paraphyses absent.

Teleutosori, hypophyllous or on the sheath; small, oblong or linear, scattered or gregarious, often confluent, always covered by the epidermis, somewhat pulvinate, compact, conspicuous, blackish; surrounded by the thick bed of brown paraphyses. Teleutospores oblong-clavate, or oblong, apex thickened ($8-10 \mu$), obtusely pointed or rounded, rarely

truncate, sometimes provided with an inconspicuous light-colored flattened papilla, base attenuated or rounded, more or less constricted at the septum, smooth, chestnut-brown, $34-54 \times 20-30 \mu$; pedicels subhyaline or brownish, short, sometimes 30μ in length, persistent.

Hab. On *Bromus japonicus* Th.

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. June 18, 1891. Y. TOKUBUCHI).

Distrib. Japan.

REMARKS. The present species differs from *Puccinia Symphyti-Bromorum* Müll. on *Bromus japonicus* and *B. pauciflorus* on many points.

The teleutospore of this species is sometimes provided at its obtusely pointed apex with a subhyaline flattened papilla-like protuberance which is often difficult to distinguish, while in *Puccinia Symphyti-Bromorum*, such a protuberance is entirely wanting. The size and general shape of the teleutospores are so conspicuously different in these two species, that I do not hesitate to consider our plant as a distinct new species.

β. Paraphyses present in uredosori.

20. Puccinia Poarum Niels. Bot. Tidsskr., **2**, 1877, (26); Winter, Pilze, 1884, (220); Sacc., Syll., **7**, 1888, (625); Schroeter, Pilz Schles., 1889, (326); Plowr., Brit. Ured. and Ustil., 1889, (168); Henn., in Engl., Bot. Jahrb., **28** 1901, (261); **31**, 1902, (732); Mayus, in Centralb. f. Bact. &c. II. **10**, 1903, (716); Klebahn, Wirtswechs. Rostpilze, 1904, (289); Sydow, Monogr. Ured., **1**, 1904. (795); Fischer, Ured. Schw., 1904, (361); McAlpine, Rusts of Australia, 1906, (128).

Hab. On *Poa annua* L.

Kurile Island.—Etrotu: Shana (II. July 29, 1884. K. MIYABE).

Hokkaidō.—Prov. Ishikari: Sapporo (II. May 20, 1891. N. HIRATSUKA & K. KIKUCHI; II. May 23, 1891; II. June 20, 1891; II. June 1894. II. June 8, 1897. K. MIYABE; II. June 11, 1898. T. KAWAKAMI; II. Oct. 1907. S. ITŌ).—Prov. Shiribeshi: Zenibako (II. June 11, 1891. Y. TOKUBUCHI).—Prov. Kitami: Rishiri-Island (II. July 21, 1899. T. KAWAKAMI).

Honshū.—Prov. Mutsu: Hirosaki (II. July 21, 1897. N. HIRATSUKA).—Prov. Rikuchū: Morio-ka (II. May 15, 1904. G. YAMADA; II. Nov. 23, 1905. K. SAWADA; II. May 3, 1897. Y. TAKAHASHI).—Prov. Musashi: Tokyo (II. April 28, 1902. N. NAMBU; II. July 1903. S. KUSANO).—Prov. Sagami Hakone (II. April 12, 1901. K. MIYABE).

Kiushū.—Prov. Higo: Ōe-mura (II. April 11, 1907. H. MATSUO).

On *Poa acroleuca* Steud.

Honshū.—Prov. Shimotsuke: Nikkō (II. June 1898, M. SHIRAI).

Shikoku.—Prov. Tosa: Sakawa-machi (II. May 1901, T. YOSHINAGA).

Kiushū.—Prov. Higo: Sunatori-mura (II. May 26, 1904, K. YOSHINO); Kumamoto (II. April 26, 1907, T. NISHIDA).

On *Poa palustris* L.

Kiushū.—Prov. Higo: Kumamoto (II. May 26, 1904, K. YOSHINO).

On *Poa palustris* L. var. *strictula* Hack.

Honshū.—Prov. Musashi: Tokyo (II. June 5, 1902, N. NAMBU).—Prov. Echigo: Fukuto-mura (II. April 20, 1903, K. YOSHINO).

On *Poa pratensis* L.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 6, 1894, K. MIYABE; II. July 21, 1895, K. MIYABE & Y. TOKUBUCHI; II. & III. Oct. 21, 1903, K. MIYABE; II. & III. Oct. 16, 1907; II. Oct. 20, 1907, S. ITO); Maruyama (II. Sept. 24, 1907, S. ITO).

On *Poa radula* Fr. et Sav.

Kurile-Island.—Etorof: Setthamai (II. July 6, 1893, S. YOKOYAMA).

On *Poa viridis* Schreb. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Oct. 16, 1907, S. ITO).

On *Deschampsia caespitosa* Beauv. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Oct. 16, 1907, S. ITO).

On *Petasites japonicus* Miq.

Hokkaidō.—Prov. Ishikari: Sapporo (I. June 20, 1891; I. June 1896, K. MIYABE; I. June 11, 1895, N. HIRATSUKA; I. June 20, 1905, K. TACHIBANA); Toyohira-mura (I. May 1890, K. MIYABE); Kataishiyama (I. June 1, 1891, Y. TOKUBUCHI); Kabato (I. July 1890, I. SHIMIZU); Jōzankei (I. June 1906, S. ITO).—Prov. Iburi: Mororan (I. June 12, 1900, K. MIYABE).—Prov. Hitaka: Monbetsu (I. Aug. 16, 1907, M. Kasai).

Honshū.—Prov. Rikuchū: Sawa-mura (I. June 17, 1877, Y. TAKAHASHI).—Prov. Ugo: Matsumine (I. T. KAWAKAMI).—Prov. Uzen: Mt. Gwassan (I. Aug. 7, 1901, G. YAMADA); Mt. Yudono (I. Aug. 14, 1905, K. MIURA).—Prov. Izu: Mt. Amagi (I. May 10, 1897, S. HORI).—Prov. Hida: Arahara (I. May 20, 1899, YAMAGUCHI).

Shikoku.—Prov. Iyo: Myojin-mura (I. May 22, 1899, K. OKUDAIRA).

Distrib. Europe, North America, Japan and Australia.

REMARKS. *Æcidium Tussilaginis* Pers. was found to have a genetic relation to the present species by NIELSEN (2) in 1877. The connection was later verified experimentally by PLOWRIGHT, WINTER, KLEBAHN and TRANZCHEL.

According to SCHROETER, the *Æcidium* stage of this fungus occurs not only on *Tussilago Farfara* but also on *Petasites albus* and *P. officinalis*.

TRANZCHEL (1) asserts that *Puccinia* on *Poa nemoralis* has no connection whatever with the *Æcidium* on *Petasites officinalis*.

In our Flora, *Tussilago Farfara* is not present. On *Petasites japonicus*, however, the aecidial stage is very commonly found; and in the vicinity of such an infected plant, there occur frequently different species of *Poa* badly attacked by *Puccinia Poarum*. It is not unreasonable, therefore, to believe in this case in the possibility of the relationship existing between two forms of rust fungi. In our country, no infection experiments have yet been made to prove their genetic connection.

The *Æcidium* on *Petasites* in our country agree in general characters to that on *Tussilago* in Europe; and in the present paper, I have considered it provisionally as a stage of *Puccinia Poarum*.

I got, from Mr. T. MIYAKE, a Saghalien specimen of *Æcidium* on *Petasites japonicus*. It was found mixed with the sori of *Puccinia expansa* Link. But as *Puccinia expansa* belongs to Hemipuccinia, having no aecidial stage, and moreover as the Saghalien *Æcidium* coincides exactly with that of Hokkaido in their morphological character, it may well be regarded as a stage of *Puccinia Poarum* and not of *Puccinia expansa*.

The uredosori of *Puccinia Poarum* are distinguished from those of other related species by the presence of characteristic capitate paraphyses.

As it has been remarked by LAGERHEIM and CARLETON, the uredospores of this species hibernate also in our country. In Sapporo, on *Poa annua*, only the uredospores seem to be formed and the teleutospores so far have never been observed. The uredospores in this case are formed throughout the year from early spring to late autumn and even under the snow in winter.

The teleutospore of our plant is slightly larger than that of the European form; but in other points they agree exactly.

In 1903, DIETEL (7) regarded the Uredo on *Poa pratensis*, collected by Mr. NAMBU at Nishigahara, as a different species from that of the present plant. I have no specimen in my hand which correspond to DIETEL's description.

I have collected in our Botanical Garden a species of *Puccinia*, much resembling the present species, on *Deschampsia caespitosa*, introduced by

seed from Dublany. The species of *Puccinia* known to infect *Aira* (*Deschampsia*) are *Puccinia graminis*, *P. coronata*, *P. borealis* and *P. Baryi*. All these species, however, do not agree with our fungus which on the contrary resembles very closely *Puccinia Poarum* and is here provisionally placed in the species under consideration.

21. *Puccinia ishikariensis* S. Ito. n. sp.—(Pl. XI. Fig. 6.)

Uredosori, epiphyllous; oblong or linear, minute, on the brownish discolored spots, gregarious, often confluent, immersed between the veins, naked, pulverulent, brown-colored. Uredospores, globose, subglobose or piriform, echinulate (distance between spines about 3μ), yellow or brownish yellow in color, $20-36 \times 14-28\mu$; episore $2-3\mu$ thick; germ-pores 6-8, scattered; paraphyses numerous, clavate or capitate, apex not thickened, yellowish, $50-80 \times 17-18\mu$.

Teleutosori, amphigenous; small, oblong or linear, densely scattered over the surface, arranged in lines, rarely confluent, long covered by the epidermis, at length naked, with the torn remains, compact, somewhat pulvinate, grey or black; surrounded by the thick bed of brown paraphyses. Uredospores are frequently mixed in the sori. Teleutospores, cylindrical, cuneate or oblong-clavate, unsymmetrical, apex thickened ($4-6\mu$), truncate, rounded or shortly apiculate, base attenuated or cuneate, not or slightly constricted at the septum, smooth, brownish-orange, lighter colored at the lower cell, $36-60 \times 14-24\mu$; episore thin; pedicels short, brown, subdeciduous.

Hab. On *Molinia japonica* Hack.

Hokkaidō.—Prov. Ishikari: Tsuishikari (II. Sept. 29, 1907. S. ITO; II. & III. Oct. 6, 1907. M. KASAI).

Distrib. Japan.

REMARKS. The species of *Puccinia* hitherto known to grow on *Molinia* are *Puccinia graminis*, *P. coronata*, *P. Moliniae*, *P. Diplachnis* and *P. australis*.

Except the one last mentioned all other species occur in Japan, and they differ entirely from the present species. Our plant differs also from *Puccinia australis*. It is distinguished from *Puccinia coronata* by the

absence of the crown, and from the other remaining species it differs by the sorus long covered by epidermis.

The shape of the teleutospores approaches nearest to that of *Puccinia glumarum* from which our plant can easily be distinguished by the uredosori provided with numerous clavate paraphyses. This fungus is often found mixed with *Puccinia Molinia* on the same leaf of the host-plant.

22. *Puccinia Ishikawai* S. Ito n. sp.—(Pl. XI. Fig. 5)

Uredosori, amphigenous; very minute, oblong, scattered, on the discolored spots, often arranged in lines, sometimes confluent, loosely covered by the epidermis or naked, somewhat pulvinate, orange-colored. Uredospores, globose or subglobose, rarely broadly ellipsoidal, finely echinulate, $22-32 \times 20-28 \mu$; epispore hyaline or yellowish; paraphyses numerous, clavate, membrane thickened, hyaline, apex not thickened, $40-80 \times 11-16 \mu$.

Teleutosori, hypophyllous; very minute, oblong or linear, scattered or subgregarious, arranged in lines, sometimes confluent, long covered by the epidermis, somewhat pulvinate, grey or blackish. Teleutospores, clavate, oblong-clavate or cuneate, apex truncate, obliquely pointed or wavy, thickened ($4-6 \mu$), base mostly attenuated, not or slightly constricted at the septum, rusty or light brown, darker colored at apex, $28-48 \times 12-20 \mu$, rarely 22μ in width; epispore thin; pedicels short, brown, subdeciduous.

Hab. On *Calamagrostis Epigejos* Roth. var. *densiflora* Led.

Hokkaidō.—Prov. Ishikari: Kotoni (III. July 26, 1901. K. MIYABE); Tsuishikari (II. & III. Sept. 21, 1902. G. YAMADA; II. & III. Sept. 29, 1907. S. ITŌ); Shiroishi (II. & III. Oct. 6, 1907. S. ITŌ); Asahigawa (II. & III. Oct. 8, 1907. S. ITŌ); Iwamizawa (II. Oct. 10, 1907. S. ITŌ).—Prov. Kitami: Sarubutogawa (III. Oct. 1892. T. ISHIKAWA); Rishiri-Island (II. & III. Aug. 15, 1907. M. MIURA).

Distrib. Japan.

REMARKS. The present species resembles closely *Puccinia pygmaea* Eriks. in general characters. But they can easily be distinguished from each other by the color of the pedicel of the teleutospore. In *Puccinia pygmaea* the pedicel is hyaline, while in our species it is brown.

γ. Uredostage not yet found.

23. *Puccinia fujiensis* S. Itō. n. sp.—(Pl. XI. Fig. 7.)

Teleutosori, hypophyllous; small, oblong or linear, scattered or subgregarious, often confluent, always covered by the epidermis, conspicuous,

blackish; surrounded by the brown paraphyses. Teleutospores, cylindrical or oblong-clavate, apex truncate or obliquely pointed, slightly thickened ($4-8 \mu$), base attenuated or angular, not or slightly constricted at the septum, smooth, ferruginous, $44-58 \times 15-17 \mu$; epispore thin; pedicels short, brown, subdeciduous.

Hab. On *Anthoxanthum japonicum* Hack.

Honshū.—Prov. Suruga: Mt. Fuji (III. July 21, 1881. J. MATSUMURA).

Distrib. Japan.

REMARKS. There are two species of *Puccinia* which have been known to grow on *Anthoxanthum*. They are *Puccinia Anthoxanthi* Fuck. and *P. borealis* Juel. *Puccinia Anthoxanthi* of Europe is distinguished macroscopically from the present species by its naked sorus. From *Puccinia borealis* of America it differs in the form and size of the teleutospores. In *P. borealis* the spore is clavate or subclavate, and smaller ($35-45 \times 13-20 \mu$).

This species approaches in its spore-shape to *Puccinia dispersa*. But the attenuation of the lower cell of the teleutospore in this species is not so abrupt as in the latter species. The general form of the spore is rather cylindrical than oblong-clavate in our species. Its septum is located in a lower position than that of *P. dispersa*.

I have not yet seen any specimen of its uredostage, which I believe will be found after a careful search. This fact makes the identification still more difficult. At any rate, the points of difference from the related species, which I have discussed, would justify us in considering this plant as a new species.

b. Teleutosorus naked.

24. *Puccinia graminis* Pers., Ten. Disp. Meth. Fung., 1797, (39); Winter, Pilze, 1884, (217); Burrill, Parasitic Fungi of Ill. 1885, (197); Sacc., Syll., **7**, 1888, (622); Schroeter, Pilz Schles., 1889, (322); Plowr., Brit. Ured. and Ustil., 1889, (162); Eriks. u. Henn., Die Getreideroste, 1896, (25); Eriks., Centralb. f. Bact. &c. II, **9**, 1902, (590); Henn., Engl., Bot. Jahrb., **31**, 1902, (731); Sydow, Monogr. Ured., **1**, 1904, (692); Fischer, Ured. Schw., 1904, (243); Dietel, Engl., Bot. Jahrb., **34**, 1905, (585); McAlpine, Rusts of Australia, 1906, (120); Butler and Hayman, Mem. of the Depart. of Agric. in India, **1**, 1906, (27); Takahashi, Trans. Sap. Nat. Hist. Soc., **1**, 1906, (41).

Hab. On *Agrostis alba* L.

Hokkaidō.—Prov. Ishikari: Iwamizawa (II. Sept. 10, 1907. S. ITŌ); Yamahana (II. Sept. 15, 1907. S. ITŌ); Garugawa (II. Sept. 22, 1907. S. ITŌ); Tsuishikari (II. & III. Sept. 29, 1907. S. ITŌ); Shiroishi (II. Oct. 6, 1907. S. ITŌ); Nagayama (II. Oct. 7, 1907. S. ITŌ); Sapporo (II. & III. Oct. 11, 1907; Oct. 20, 1907. S. ITŌ).

Honshū.—Prov. Rikuchū: Morioka (II. Sept. 12, 1906. G. YAMADA).

On *Agrostis canina* L. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Oct. 20, 1906. S. ITŌ).

On *Agrostis stolonifera* L. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Oct. 20, 1906. S. ITŌ).

On *Avena chinensis* Hort. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 16, 1906. M. MIURA).

On *Avena sativa* L.

Hokkaidō.—Prov. Ishikari: Sapporo (II. Sept. 12, 1903. T. MIYAKE).

On *Avena sterilis* L. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. Oct. 1907. S. ITŌ).

On *Avena strigosa* Schreb. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (II. Oct. 1907. S. ITŌ).

On *Hordeum sativum* Jessen.

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Sept. 14, 1905. K. MIYABE & J. HANZAWA)

Honshū.—Prov. Uzen: Yamagata (III. Nov. 10, 1907. S. MURAYAMA).

On *Triticum monococcum* L. (cult.)

Hokkaidō.—Prov. Ishikari: Sapporo (III. Sept. 1902; II. & III. Nov. 5, 1903. T. MIYAKE)

On *Triticum vulgare* Vill.

Saghalien.—Ūgorinuepadji (III. Oct. 12, 1906. T. MIYAKE).

Hokkaidō.—Prov. Ishikari: Shiroishi (III. Aug. 25, 1894. N. HIRATSUKA); Sapporo (III. Oct. 12, 1907. S. ITŌ); Tsuishikari (II. Sept. 29, 1907. S. ITŌ); Ebetsu (III. Sept. 29, 1907. S. ITŌ).

Honshū.—Prov. Rikuchū: Morioka (II. & III. July 21, 1901. G. YAMADA).—Prov. Settsu: Ōsaka (III. Sept. 1906. A. IGETA).—Prov. Echigo: Yoshida-mura (III. July 23, 1908. S. ITŌ); Tsubame (II. & III. July 26, 1908. S. ITŌ).

Kiushū.—Prov. Higo: Kumamoto (II. June 2, 1907. T. NISHIDA; III. May 7, 1905. K. YOSHINO & S. MAIHARA; II. & III. June 19, 1904. K. YOSHINO).

Formosa.—Ensuikō (II. 1907. T. KAWAKAMI); Daihoku (II. & III. 1907. T. KAWAKAMI & R. SUZUKI).

On *Berberis vulgaris* L.

Hokkaidō.—Prov. Ishikari: Sapporo (I. June 2, 1890. K. MIYABE).—Prov. Oshima: Hakodate (I. July 10, 1890. K. MIYABE).—Prov. Hitaka (I. June 1884. K. MIYABE).—Prov. Shiribeshi Isoya (I. July 18, 1888. K. MIYABE).

Honshū.—Prov. Echigo: Mt Tohō (I. Aug. 12, 1908, S. Irō).

Distrib. Asia, Africa, Europe, America and Australia.

REMARKS. The "black rust," as the present species is popularly called, was known from ancient times in several countries. Naturally the works on this species are numerous, but those cited above are the most important concerning its classification.

In 1865, the *Æcidium* on *Berberis* was for the first time proved scientifically by DE BARY as a stage in the life cycle of this species. This is the beginning of our knowledge on heteroecism. J. ERIKSSON and E. HENNING (2) studied this species quite exhaustively and enumerated as its host-plant the names of 109 species of grasses. He (6) classified this species as the result of his own infection experiments into the following specialized forms :—

1. *f. sp. Secalis.*
2. *f. sp. Tritici.*
3. *f. sp. Avenae.*
4. *f. sp. Airae.*
5. *f. sp. Agrostis.*
6. *f. sp. Poae.*

However, in North America, CARLETON (1) found only the following two specialized forms well established; namely, 1. *f. sp. Tritici* and 2. *f. sp. Avenae*.

In our country, barley, oats, wheat and *Agrostis* are known as the host-plants of this fungus. Especially wheat seems to be most severely attacked.

25. ***Puccinia kozukensis*** Diet., in Engl., Bot. Jahrb., **32**, 1903, (48); Sydow, Monogr. Ured., **1**, 1904, (721); Sacc., Syll., **17**, 1905, (379).

Hab. On *Andropogon micranthus* Kth.

Honshū.—Prov. Kōzuke: Mt. Myōgi (III. Nov. 4, 1899, S. KUSANO).—Prov. Hitachi (III. Oct. 11, 1900).—Prov. Ugo: Akita (III. Nov. 1903, Y. TOKUBUCHI).

Distrib. Japan.

REMARKS. As has been well remarked by DIETEL (6), the present species is very easily distinguished from other species of *Puccinia* on *Andropogon* by the roundish form of its teleutospore, and also by the thinner epispore of its lower cell.

26. *Puccinia Nakanishikii* Diet. in Engl., Bot. Jahrb., **34**, 1905, (585); **37**, 1906, (101); Sydow & Butler, in Ann. Mycol., **4**, 1906, (435).—(Pl. XI. Fig. 10).

Syn.: *Puccinia purpurea* P. Henn. in Engl., Bot. Jahrb., **28**, 1901, (261).

Hab. On *Andropogon Nardus* L. var. *Gæringii* Hack.

Honshū.—Prov. Musashi: Kōnodai (II. Oct. 15, 1904. S. KUSANO).—Prov. Awa: Mt. Nokogiri (III. Oct. 21, 1882. K. MIYABE).

Shikoku.—Prov. Tosa: Mt. Washio (II. Oct. 1903. NAKANISHIKI); Engyoji (II. Oct. 1907. T. YOSHINAGA).

Distrib. Japan and India.

REMARKS. I agree with DIETEL (8) in his view as to the wide variation in color (from light brown to deep chestnut-brown) of the paraphyses, and also as to the deeper color of the pedicel at its upper portion.

The teleutosori of this species have never described. I was able, however, to observe that stage, on the specimen collected by Prof. K. MIYABE in 1882 at Mt. Nokogiri, Prov. Awa. The teleutosori are hypophyllous, small, oblong or linear on brownish discolored spots, and are scattered or gregarious, sometimes confluent. They are naked, with torn epidermis, somewhat pulvinate, and blakish chestnut-brown in color.

In 1906, SYDOW and BUTLER (1) reported this species to be parasitic on the same host-plant in India and they have noted that the teleutospore of the Indian species has a thicker wall than that of the Japanese species.

27. *Puccinia purpurea* Cke. in Grevillea, **5**, 1876, (15); Sacc., Syll., **7**, 1888, (657); Barclay, Journ. of Bot., **28**, 1890, (257); Busse, Ber. Deutsch. Bot. Ges., **20**, 1902, (283); Arb. aus. d. Biol. Abt. f. Land. u. Forstw. am Kaiserl. Gesundh., **4**, 1904, (319); Zimmermann, Berichte ü. Land u. Forstw. in Deut. Ostafrika, **2**, 1904, (15); Sydow, Monogr. Ured., **1**, 1904, (803); McAlpine, Rusts of Australia, 1906, (129); Takahashi, Trans. Sap. Nat. Hist. Soc., **1**, 1907, (8).

Hab. On *Andropogon Sorghum* Brot. var. *vulgaris* Hack.

Kiushū.—Prov. Higo: Ōemura (II. & III. Sept. 29, 1905. K. YOSHINO).

Formosa.—Daihoku: Kawayashiki (II. Dec. 2, 1906. R. SUZUKI).

Distrib. Asia, Africa and Europe.

REMARKS. BUSSE (I. 2.) described this species most fully in his papers on sorghum-rust in German East Africa, and supplemented thereby the incomplete description of COOKE (1).

The host-plants of this species hitherto known are *Andropogon Sorghum*, *A. Halepensis*, *Zea Mays* and *Pennisetum typhoideum*. The occurrence of this rust fungus on the first mentioned host-plant in our country, P. HENNINGS (1) asserts by examining the specimen collected in Tokyo, but DIETEL (8) is of opinion that *Puccinia purpurea* of P. HENNINGS may not be different from his *Puccinia Nakanishikii*.

28. *Puccinia Arundinellae anomalae* Diet. in Engl., Bot. Jahrb., **37**, 1906, (100); in Ann. Mycol., **5**, 1907, (73).—(Pl. XI. Fig. 11.)

Syn.: *Puccinia graminis* Diet. in Engl., Bot. Jahrb., **32**, 1903, (48).

Hab. On *Arundinella anomala* Steud.

Hokkaidō.—Prov. Oshima: Zenikamezawa (III. Oct. 12, 1900. T. KAWAKAMI; III. 1896.)—Prov. Ishikari: Garugawa (III. Sept. 22, 1907. S. IRŌ).

Honshū.—Prov. Kōzuke: Mt. Myogi (III. Nov. 4, 1899. S. KUSANO).—Prov. Musashi: Tsurumi (III. Oct. 26, 1904. N. NAMBU); Tokyo (III. Sept. 1904. M. SHIRAI; II. & III. Oct. 24, 1904. S. KUSANO); Nishigahara (II. & III. April 17, 1899. S. HORI).

Shikoku.—Prov. Tosa: Tōchi-mura (III. Sept. 1906; III. Oct. 1906. T. YOSHINAGA).

Kiushū.—Prov. Higo: Mt. Aso (III. Oct. 12, 1905. K. YOSHINO); Yamauchi-mura (III. Nov. 3, 1906. K. YOSHINO).—Prov. Bungo: Sugō-mura (III. Sept. 4, 1905. K. YOSHINO).

Distrib. Japan, China and Siberia.

REMARKS. DIETEL (9) regarded this species as a new one, separating it from *Puccinia Arundinellae* Barcl., by its slender teleutospores. He based this determination on the specimen collected by Prof. S. KUSANO in Tokyo in 1904.

Previous to this period DIETEL (6) identified the specimen on the same host-plant collected by Prof. S. KUSANO in 1899 at Mt. Myogi, Prov. Kōzuke, to be *Puccinia graminis*.

In 1902, P. HENNINGS (3) also noticed the occurrence of *Puccinia graminis* on *Arundinella anomala*, which was collected by Mr. T. YOSHINAGA in 1901, at Akatouchi-toge, Prov. Tosa.

Thus according to the European authorities, there seem to exist two

species of *Puccinia* in our country on *Arundinella anomala*. On this point, I have sufficient reason to doubt its validity.

I obtained, by the kindness of Prof. S. KUSANO, both of the type specimens on which DIETEL based his determination. In the course of my study on both of these type specimens, my attention was drawn to the similarity between them. The pedicel of *Puccinia Arundinellae anomalae* is hyaline or light brownish yellow in color; while that of *Puccinia graminis* is also light brownish or sometimes hyaline. Thus, to distinguish them by the color of the pedicel becomes totally impossible.

The color of the pedicel is not an essential factor in the point of classification in *Puccinia*, at least, it is true in the case of *Puccinia* on Gramineae. For example, the pedicels of *Puccinia erythropus*, *P. rufipes*, *P. Eulaliae* and *P. Arundinellae* and also those of many other species vary pretty often in their color. So, simply from the color difference of the pedicels the so called *Puccinia graminis* on *Arundinella* may not be different from PERSOON'S *Puccinia graminis*. But uredospores which were accidentally found on the type specimen of the so called *Puccinia graminis*, differ utterly from those of *P. graminis*, but correspond exactly to those of the present species. I wish, for the reasons above mentioned, to include the Myogi specimen in *Puccinia Arundinellae anomalae*.

As has already been mentioned, this species is distinguished from *Puccinia Arundinellae* of Himalaya by the slender teleutospores. But it must be remembered that the dimensions of some of our species approach that of *P. Arundinellae*. Among specimens, collected at Garugawa, Tsurumi and other places, there were few spores which measure above $42\ \mu$. Generally, while young, the color of the teleutospore is light colored and slender in shape, but when ripened its color is darker and more or less roundish in shape. After all, our species may not be different from the Himalayan species. Further study is needed to settle this point.

29. *Puccinia culmicola* Diet. in Engl., Bot. Jahrb., **37**, 1906, (100).—
(Pl. XI. Figs. 8, 9.)

Hab. On *Brachypodium japonicum* Miq.

Honshū.—Prov. Musashi: Komaba (II. & III. Sept. 18, 1900. S. KUSANO).

On *Agropyrum semicostatum* Nees?

Honshū.—Prov. Rikuchū: Morioka (III. Nov. 12, 1905. G. YAMADA).

Distrib. Japan.

REMARKS. DIETEL (9) described this species from the specimen collected by Prof. S. KUSANO in Tokyo. It differs from other Puccinia on *Brachypodium* by the naked teleutosori and non-coronate teleutospores and by the invariable occurrence of the sori on the culm.

I have found among the specimens sent to me from Prof. G. YAMADA, a species of Puccinia on *Agropyrum semicostatum*? which coincides closely with the type specimen of this species on *Brachypodium*.

30. Puccinia stichosora Diet., in Engl., Bot. Jahrb., **37**, 1906, (100).

Hab. On *Calamagrostis arundinacea* Roth. var. *sciuroides* Hack.

Honshū.—Prov. Musashi: Tokyo (II. Sept. 15, 1904. N. NAMBU).

Distrib. Japan.

REMARKS. By the kindness of Mr. N. NAMBU, I have been able to examine the type specimen of this species in its uredostage. The uredospores of this species differ from those on *Calamagrostis* by the darker color of their epispore.

31. Puccinia Cynodontis Desm. Exs. **3**, no 655; Winter, Pilze, 1884, (180); Sacc., Syll., **7**, 1888, (661); Magnus, in Verhandl. Zool. bot. Ges., **49**, 1899, (95); Sydow, Monogr. Ured., **1**, 1904, (748); McAlpine, Rusts of Australia, 1906, (118).

Syn.: *Puccinia varians* Diet., in Ann. Mycol., **6**, 1908, (224).

Hab. On *Cynodon Dactylon* Pers.

Honshū.—Prov. Musashi: Tokyo (II. Nov. 1899. M. SHIRAI; III. Oct. 23, 1904. S. KUSANO).
—Prov. Echigo: Yoshida (III. Aug. 18, 1908. S. ITO).

Shikoku.—Prov. Tosa: Kōchi (III. Nov. 1906. T. YOSHINAGA).

Distrib. Europe, Asia and Africa.

REMARKS. No account concerning the occurrence of this species in our country, except a short note by Prof. S. KUSANO (2), has yet been published.

In 1899, P. MAGNUS (2) remarked that there are two kinds of uredospores in this species. One kind has a thin echinulate wall with numerous germ-pores (to 9) located at the upper portion of the spore. Another kind

has a smooth or scarcely echinulate wall with a few germ pores (1-3). However, according to him, there are transitional forms between these two kinds. I have observed only the latter kind of uredospores in Japanese specimens.

Lately, W. TRANZCHEL (2) proved the genetic relation of the present species by infection experiments to *Æcidium Plantaginis* on *Plantago lanceolata* in Russia. At about same time, Fr. Bubák (1) also obtained the similar results, but he failed to prove the relationship of the *Æcidia* on *Plantago major*, *P. media*, *P. Cynops* and *P. Psyllum* with this species. *Æcidium Plantaginis* on *Plantago major* occurs very commonly in our country, but *Æcidium* on *Plantago lanceolata* is not yet found.

In 1908, DIETEL (12) described this fungus sent from Japan as a new species under the name of *Puccinia varians*. His description correspond closely that of *Puccinia Cynodontis*, but he did not give any remarks on the affinity with the latter species.

32. Puccinia Diplachnis Arth. in Bull. Torr. Bot. Club, **31**, 1904, (4); Sydow, Monogr. Ured., **1**, 1904, (900); Sacc., Syll., **17**, 1905, (383); Kusano, Bot. Mag. Tokyo, **18**, 1904, (148).

Hab. On *Diplachne serotia* Link. var. *aristata* Hack.

Honshū.—Prov. Musashi: Tokyo (II. & III. Nov. 8, 1904. S. KUSANO).

Distrib. North America and Japan.

REMARKS. Prof. S. KUSANO (1) identified the present species to *Puccinia Diplachnis* of North America.

33. Puccinia rufipes Diet. in Engl., Bot. Jahrb., **32**, 1903, (48); Ann. Mycol., **5**, 1907, (73); Sydow, Monogr. Ured., **1**, 1904, (757); Sacc., Syll., **17**, 1905, (377).

Hab. On *Imperata arundinacea* Cyr. var. *Kocnigii* Hack.

Honshū.—Prov. Musashi: Itabashi (III. Oct. 10, 1895, S. HORI); Tokyo (III. Sept. 28, 1899; II. & III. Oct. 28, 1899; III. Sept. 24, 1904. S. KUSANO; III. Oct. 26, 1899. T. NISHIDA); Ōmiya (III. Nov. 20, 1899. T. NISHIDA); Nakano (III. Nov. 20, 1900. N. NAMBU); Awoyama (III. Nov. 1901. K. YOSHINO).

Shikoku.—Prov. Tosa (II. 1901. T. YOSHINAGA).

Distrib. Japan.

REMARKS. The characteristic of the present species is, as its specific name indicates, a deep reddish color of pedicels of its teleutospores.

This is one of the two species of *Puccinia* hitherto known to be parasitic on *Imperata arundinacea* var. *Koenigii*, another species being *Puccinia Eulaliae*.

According to my own observations, the maximum length of its teleutospores is 42 μ , while DIETEL (6) limited it to 33 μ .

34. *Puccinia erythropus* Diet. in Engl., Bot. Jahrb., **37**, 1906, (101); Ann. Mycol., **6**, 1908, (224).—(Pl. XI. Fig. 12).

Hab. On *Miscanthus sinensis* Anders.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 28, 1895; III. Oct. 1895. Y. TOKUBUCHI); Maruyama (III. Sept. 9, 1895, N. HIRATSUKA & K. KIKUCHI; III. Oct. 3, 1902. K. MIYABE); Mt. Moiwa (III. Sept. 24, 1901; III. Oct. 24, 1901; III. Oct. 28, 1901. G. YAMADA; III. Oct. 19, 1903. K. MIYABE; III. Oct. 11, 1903. J. HANZAWA); Garugawa (III. May 21, 1899. K. MIYABE; III. Oct. 24, 1905. J. HANZAWA & S. ITO); Tsuishikari (III. Sept. 29, 1907. S. ITO; III. Oct. 6, 1907. M. KASAI); Ishiyama (III. Oct. 11, 1905. J. HANZAWA); Barato (III. Oct. 24, 1897. T. NISHIDA); Horomui (III. Oct. 1891; III. Sept. 22, 1894. Y. TOKUBUCHI); Ikushunbetsu (III. Oct. 1, 1902. T. MIYAKE).—Prov. Shiribeshi: Raiden-tōge (III. Oct. 6, 1901. G. YAMADA); Tsukigoe (III. Oct. 24, 1905. R. OGAWA); Shikuzushi (III. Oct. 13, 1903. K. MIYABE).—Prov. Oshima: Junsainuma (III. Sept. 27, 1899. K. MIYABE).

Honshū.—Prov. Rikuchū: Morioka (III. Oct. 28, 1906. K. OKUMURA).—Prov. Uzen: Akita (III. Nov. 1903. Y. TOKUBUCHI).—Prov. Musashi: Komaba (III. Oct. 20, 1895. K. SENGOKU; II. Nov. 1899. M. SHIRAI).

Shikoku.—Prov. Tosa: Umaji-mura (III. Oct. 1904. T. YOSHINAGA); Sakanoue (III. Oct. 1904. T. YOSHINAGA); Ōsakayama (III. Sept. 1906. T. YOSHINAGA).—Prov. Iyo: Minamiuwa-gun (II. 27, 1907. T. NISHIDA); Aratachi (III. Nov. 20, 1906. T. NISHIDA).

Kiushū.—Prov. Higo: Mt. Aso (III. Oct. 12, 1905. K. YOSHINO).

On *Miscanthus sacchariflorus* Hack.

Honshū.—Prov. Echigo: Santō-gun (III. Dec. 15, 1903. K. YOSHINO).

Distrib. Japan.

REMARKS. Comparing the specimens of this fungus with the description by DIETEL, I feel it necessary to make the two following remarks.

1. Although in the original description of the present species by DIETEL, the sorus is said to be epiphyllous, my own observation shows, the fact to be just the opposite. The type specimen as well as all other specimens I have examined present invariably the hypophyllous sori.

2. In regard to the size of the uredospore, there are some differences

between his statement and my own actual measurements ($28-34 \times 20-25 \mu$), mine being a little larger.

In 1908, the same author (12) wrote that this fungus grows also on *Calamagrostis sciuroides* Fr. et Sav. But I have not yet found any specimen of *Calamagrostis* bearing this parasite and I hesitate, at any rate, to accept his statement.

A criterion, by which we can easily distinguish it from other species, is the wider diameter of the lower cell of the teleutospore at the portion just below the septum.

35. *Puccinia Eulaliae* Barcl., in Journ. Asiatic Soc. Bengal, 60, 1891, (216); Sacc., Syll., 11, 1895, (199); Henn., in Engl., Bot. Jahrb., 31, 1902, (732); Dietel, in Engl., Bot. Jahrb., 27, 1900, (569); 32, 1903, (48); 32, 1903, (625); Sydow, Monogr. Ured., 1, 1904, (797).

Hab. On *Miscanthus sinensis* Anders.

Hokkaidō.—Prov. Ishikari: Okatama-mura (III. Nov. 23, 1890. K. MIYABE); Horomui (III. Oct. 1892. Y. TOKUBUCHI); Maruyama (III. Sept. 9, 1895. N. HIRATSUKA & K. KIKUCHI); Sapporo (III. Oct. 28, 1895. Y. TOKUBUCHI); Tsuishikari (III. Sept. 21, 1902. G. YAMADA; III. Sept. 29, 1907. S. ITŌ); Mt. Moiwa (II. & III. Aug. 18, 1907. S. ITŌ); Ishiyama (III. Oct. 11, 1905. K. MIYABE); Shiroishi (III. Oct. 6, 1907. S. ITŌ); Nagayama (III. Oct. 7, 1907. S. ITŌ).—Prov. Iburi: Abuta (II. Aug. 17, 1897. T. NISHIDA); Chitose (III. Oct. 10, 1900. G. YAMADA).—Prov. Oshima: Zenikamezawa (III. Oct. 12, 1900. T. KAWAKAMI); Okushiri-Island (III. Nov. 3, 1900. T. KAWAKAMI).—Prov. Kitami: Rishiri-Island (III. Sept. 2, 1899. T. KAWAKAMI; III. Aug. 20, 1907. M. MIURA).

Honshū.—Prov. Rikuchū: Morioka (II. & III. Oct. 17, 1907. G. YAMADA).—Prov. Musashi: Tokyo (III. Oct. 15, 1891. S. HORI; III. Nov. 25, 1898. M. MIYOSHI; II. & III. Oct. 28, 1899. S. KUSANO; III. Nov. 20, 1899. T. NISHIDA; III. Sept. 18, 1900. S. KUSANO; II. Oct. 18, 1900. T. FUKUHARA; II. & III. Nov. 14, 1901. K. YOSHINO; III. Nov. 9, 1904. N. NAMBU).—Prov. Echigo: Yahiko (II. July 23, 1908. S. ITŌ); Mazetōge (II. Aug. 9, 1908. S. ITŌ); Mt. Yahiko (II. Aug. 12, 1908. S. ITŌ); Mt. Kanazu (II. Aug. 19, 1908. S. ITŌ).—Prov. Sagami: Mitaki (II. Aug. 24, 1900. G. YAMADA).—Prov. Mino: Mt. Kinkwa (III. Nov. 10, 1898. Y. TOKUBUCHI).—Prov. Suwō: Yamaguchi (III. Sept. 1903. A. IGETA).

Kiushū.—Prov. Higo: Mt. Aso (II. Oct. 12, 1905; III. Oct. 13, 1905. K. YOSHINO).—Prov. Bungo: Ōita (II. June 1905. K. YOSHINO); Miemachi (II. June 15, 1905. K. YO HINO).

Formosa.—Daihoku: Tansui (II. Jan. 4, 1907. R. SUZUKI).

On *Miscanthus Sacchariflorus* Hack.

Honshū.—Prov. Musashi: Kami-itabashi (III. Oct. 29, 1904. S. KUSANO).—Prov. Echigo: Yoshida (II. Aug. 10, 1908. S. ITŌ); Mt. Gomadō (II. Aug. 20, 1908. S. ITŌ).

On *Miscanthus condensatus* Hack.

Honshū.—Prov. Musashi: Tokyo (III. Oct. 26, 1899. S. KUSANO).

On *Miscanthus* sp.

Honshū.—Prov. Mutsu : Goshogawara (III. Oct. 1904. T. KASHIWA).

Distrib. Japan and India.

REMARKS. BARCLAY (3) tells nothing of the uredosori of this fungus ; and his descriptions of the uredospores are made from those mixed in the teleutosori. Uredosori of this species are hypophyllous, small, roundish, oblong or linear in form, scattered or subgregarious on a characteristic dark reddish spot, often confluent (6 mm in length), naked, with torn epidermis on their margins, pulverulent, and brown in color.

According to DIETEL (7), this fungus grows also on the leaves of *Imperata arundinacea*, in which case the uredospores are said to be slightly smaller than those on *Miscanthus sinensis*. I have not been able so far to find the present species on *Imperata arundinacea*. Besides these two host-plants, two other species are added in this paper, namely *Miscanthus sacchariflorus* and *M. condensatus*.

36. Puccinia Molinia Tul. in Ann. Sc. nat. soc., 6 s. 2, 1854, (141) ; Winter, Pilze, 1884, (219) ; Sacc., Syll., 7, 1888, (631) ; Plowr., Brit. Ured. and Ustil., 1889, (179) ; Schroeter, Pilz Schles., 1889, (332) ; Klebahn, in Zeits. f. Pflanzenk., 4, 1894, (138) ; 6, 1896, (268) ; 9, 1899, (156) ; Sydow, Monogr. Ured., 1, 1904, (762) ; Fischer, Ured. Schw., 1904, (256).

Hab. On *Molinia japonica* Hack.

Hokkaidō.—Prov. Oshima : Oshamanbe (III. Aug. 11, 1892. T. KAWAKAMI).—Prov. Ishikari : Horomui (III. Sept. 21, 1894. Y. TOKUBUCHI) ; Tsuishikari (III. Sept. 21, 1902. G. YAMADA ; III. Sept. 29, 1907. S. ITÔ ; III. Oct. 6, 1907. M. KASAI) ; Chasinai (III. Oct. 10, 1908. J. IKEDA).

Distrib. Europe and Japan.

REMARKS. I have not able to find any uredosorus of this fungus in Hokkaido. SYDOW (2) also remarks that the uredosori are very scarce in Europe, as the uredospores are soon replaced by the teleutospors, converting them into teleutosori.

The teleutospores of this species resemble somewhat those of *Puccinia Phragmitis*, but they are generally shorter in length and broader in width than those of the latter. These two species can readily be distinguished from each other by their uredospores. The uredospores of *Puccinia Molinia*

have thicker walls (6-8 μ) and smaller size (20-28 \times 20-24 μ). This species is a new addition to our fungus-flora.

37. *Puccinia oahuensis* Ell. et Ev., Bull. Torr. Bot. Club., **22**, 1895, (425); Sacc., Syll., **14**, 1899, (357); Sydow, Monogr. Ured., **1**, 1904, (771); Dietel, Ann. Mycol., **5**, 1907, (73).

Hab. On *Panicum sanguinale* L.

Shikoku.—Prov. Tosa: Akimachi (II. Oct. 1905. T. YOSHINAGA); Ushioemura (II. Oct. 1906. T. YOSHINAGA).

Distrib. Japan and Hawaiian Islands.

REMARKS. The present species was first found parasitic on *Panicum pruriens* on Oahu Island in Hawaii.

Mr. T. YOSHINAGA kindly sent to me the specimens of the present species on *Panicum sanguinale*. The Japanese plant shows a great similarity to that of Oahu, and, in fact, no points of difference between them are to be seen as was identified by DIETEL (10). The teleutosori, it is said, were not found in the Oahu specimen. This is true also of our plant. The teleutospores are found mixed in the uredosori.

38. *Puccinia Phlei-pratensis* Eriks. et Henn., in Zeits. f. Pflanzenk., **4**, 1894, (140); Getreideroste, 1896, (130); Sacc., Syll., **11**, 1895, (204); Sydow, Monogr. Ured., **1**, 1904, (784); Fischer, Ured. Schw., 1904, (260).

Hab. On *Phleum pratense* L.

Hokkaidō.—Prov. Ishikari: Sapporo (II. Oct. 23, 1906. K. MIURA).

Distrib. Europe and Japan.

REMARKS. This species was at first included in *Puccinia graminis*, as there are apparently no distinct morphological differences between them. ERIKSSON and HENNING (2) proved that this species has no relation to the *Æcidium* on *Berberis* and that the uredospores have the hibernating power. From these physiological differences, these authors are led to consider them as distinct species. In 1907, POLE EVANS (1) proved the existence of the decided morphological differences between them by his cytological investigations of their uredo mycelia.

39. *Puccinia Magnusiana* Koern., in Hedw., **15**, 1876, (179); Winter,

Pilze, 1834, (221); Sacc., Syll., 7, 1888, (631); Plowr., Brit. Ured. and Ustil., 1889, (177); Schroeter, Pilz Schles., 1889, (332); Klebahn, in Zeits. f. Pflanzenk., 2, 1892, (337); Wirtswechs. Rostpilze, 1904, (285); Sydow, Monogr. Ured., 1, 1904, (785); Fischer, Ured. Schw., 1904, (241); Dietel, in Engl., Bot. Jahrb., 37, 1906, (100); McAlpine, Rusts of Australia, 1906, (125).

Hob. On *Phragmites communis* Trin.

Saghalien.—Dalni (III, Sept. 29, 1906. T. MIYAKE).

Hokkaidō.—Prov. Ishikari: Sapporo (III, Oct. 1889. K. MIYABE; III, Sept. 9, 1894. N. HIRATSUKA; III, Oct. 20, 1895. Y. TOKUBUCHI; III, Oct. 4, 1896. K. MIYABE; III, Oct. 1896. J. HANZAWA; III, Oct. 10, 1899; III, Oct. 13, 1905. K. MIYABE; III, Nov. 4, 1907. M. KASAI; II, Oct. 1, 1907; III, Oct. 4, 1907; III, Sept. 29, 1907. S. ITO; III, March 4, 1908. H. TAKEDA); Maruyama (III, Sept. 24, 1907. S. ITO); Iwamizawa (III, Oct. 10, 1907. S. ITO); Shiroishi (II. & III, Aug. 8, 1891; III, Oct. 13, 1895. N. HIRATSUKA; III, Sept. 22, 1907. M. KASAI; III, Oct. 6, 1907. S. ITO); Garugawa (II. & III, Sept. 22, 1907. S. ITO); Nagayama (III, Oct. 7, 1907. S. ITO); Tsuishikari (III, Sept. 21, 1902. G. YAMADA); Ebetsu (III, Sept. 29, 1907. S. ITO); Chikabumi (III, Dec. 25, 1904. T. MIYAKE).—Prov. Iburi: Rebunge (III, Aug. 18, 1897. T. NISHIDA); Chitose (III, Oct. 13, 1900. G. YAMADA); Izai (II. & III, Sept. 20, 1905. K. MIURA).

Honshū.—Prov. Ugo: Sakata (II, Aug. 2, 1901. G. YAMADA).—Prov. Musashi: Tokyo (III, Jan. 3, 1900. T. NISHIDA; III, Dec. 10, 1901; II. & III, Oct. 20, 1902. K. YOSHINO; III, Sept. 11, 1905. T. KARASHIMA).—Prov. Echigo: Yahagi (II, July 22, 1908. S. ITO); Tsubame (II, July 26, 1908. S. ITO); Yahiko (II, July 28, 1908. S. ITO).

Shikoku.—Prov. Tosa: Azono (III, Oct. 1906. T. YOSHINAGA); Ushio (III, Oct. 1906. T. YOSHINAGA).

Kiushū.—Prov. Higo: Ōe-mura (III, Dec. 1905. K. YOSHINO); Mt. Aso & Kuchinoki (II, Nov. 23, 1905. K. YOSHINO); Tamukai-mura (III, Dec. 12, 1905. K. NAKANO).—Prov. Hizen: Saga (III, Nov. 1906. Y. HORIKAWA).—Prov. Chikuzen: Yanagawa (III, Sept. 18, 1906. K. YOSHINO).

On *Ranunculus repens* L.

Saghalien.—Kshunnai (I, July 7, 1906. T. MIYAKE); Korsakoff (I, July 11 & 12, 1906. K. MIYABE & T. MIYAGI); Chipisani (I, July 16, 1906. K. MIYABE, T. MIYAKE & T. MIYAGI); Dalni (I, July 29, 1906. T. Miyake).

Hokkaidō.—Prov. Ishikari: Sapporo (I, June 1890. K. MIYABE; I, June 16, 1891; I, June 28, 1891. Y. TOKUBUCHI); Barato (I, June 18, 1893. K. MIYABE); Horomui (I, June 13, 1897. G. YAMADA).

Honshū.—Prov. Musashi: Tokyo (I, 1883. K. MIYABE).

Distrib. Europe, Japan and Africa.

REMARKS. This species was at first proved by CORNU (1) to have a connection with the *Æcidium* on *Ranunculus repens*. PLOWRIGHT, ED. FISCHER and KLEBAHN affirmed his statement.

The present species is often found mixed with *Puccinia Phragmitis* on the same leaves of *Phragmites communis*. Macroscopically the sorus of this species is considerably smaller and less pulvinate than that of *Puccinia Phragmitis*.

The *Æcidium* on *Ranunculus repens* is very commonly found in our country, and they agree exactly to the description made by FISCHER (1) on the European plants. Although there is no record in Europe concerning the presence of the spermogonia, in our species they are found on the upper surface of the leaf.

40. *Puccinia moriokaensis* S. Itō. n. sp. (Pl. XII. Fig. 1).

Teleutosori, amphigenous, mostly hypophyllous; medium sized, oblong or sublinear, scattered or gregarious, often confluent (2.5 mm in length), naked, with torn epidermis, pulvinate, compact, thick, prominent, black. Teleutospores, fusiform or oblong-clavate, apex apiculate, rarely truncate or rounded, thickened (6-12 μ), base attenuated, not or slightly constricted at the septum, smooth, chestnut-brown, darker colored at apex, 44-70 \times 12-18 μ ; pedicels persistent, slender, very long, 80-100 μ , often 120 μ in length, hyaline or light yellowish brown.

Hab. On *Phragmites communis* Trin.

Honshū.—Prov. Fikuchī: Morioka (III. Oct. 29, 1905. G. YAMADA & K. SAWADA).

Distrib. Japan.

REMARKS. This species is found growing together with *Puccinia Magnusiana* on the same leaf of *Phragmites communis*. Its sorus is comparatively larger than that of the latter species; so that, macroscopically, it resembles rather that of *Puccinia Phragmitis*. Microscopically, however, the present species differs distinctly from *Puccinia Phragmitis* and approaches rather to *Puccinia Magnusiana*.

When comparing this species with other species of *Puccinia* on *Phragmites*, I was unable to find any species that would coincide exactly with it. From *Puccinia Phragmitis* (Schm.) Koern., *P. Trailii* Plowr., *P. obtusata* (Otth.) Ed. Fischer, *P. Isiaceæ* (Thüm.) Wint., *P. Tepperi* Ludw., *P. torosa* Thüm., and *P. Trabutii* Roem et Sacc., our species is easily distinguished by its slender teleutospore and from *Puccinia Magnusiana* Koern., *P. simi-*

lima Arth., and *P. invenusta* Syd., by its longer pedicel and slender spore. Consequently, I am inclined to regard it as a new species.

41. Puccinia Phragmitis (Schm) Koern., in Hedw., **15**, 1876, (179); Winter, Pilze, 1884, (179); Sacc., Syll., **7**, 1888, (630); Plorwr., Brit. Ured. & Ustil., 1889, (175); Schroeter, Pilz Schles., 1889, (331); Kleb., in Zeits. f. Pflanzenk., **2**, 1892, (337); **8**, 1898, (26); Wirtswechs. Rostpilze, 1904, (283); Mayus, Centralb. f. Bact. &c. II., **10**, 1903, (711); Henn., Engl. bot. Jahrb., **29**, 1901, (147); **31**, 1902, (732); **34**, 1905, (596); Sydow, Monogr. Ured., **1**, 1904, (787); Fischer, Ured. Schw., 1904, (250); Dietel, Ann. Mycol., **5**, 1907, (73).

Hab. On *Phragmites communis* Trin.

Saghalien.—Kshunnai (II. & III. Aug. 10, 1906. K. MIYABE & T. MIYAGI); Ushoro (II. & III. Aug. 11, 1906. K. MIYABE & T. MIYAGI).

Hokkaidō.—Prov. Ishikari: Sapporo (II. & III. Aug. 4, 1889. K. KODERA; III. Aug. 1895. Y. TOKUBUCHI; III. Oct. 10, 1895; III. Oct. 4, 1896. K. MIYABE; III. Oct. 13, 1905. N. HIRATSUKA & J. HANZAWA; II. July 20, 1907; III. Sept. 10, 1907; III. Oct. 13, 1907; III. Dec. 1907. S. ITŌ; II. Sept. 2, 1907. M. KASAI); Chikabumi (III. Dec. 25, 1904. T. MIYAKE); Garugawa (III. Sept. 22, 1907. S. ITŌ); Ebetsu (III. Sept. 29, 1907. S. ITŌ); Shiroishi (III. Oct. 6, 1907. S. ITŌ); Takikawa (III. Oct. 8, 1907. M. KASAI).—Prov. Iburi: Usu (II. Aug. 15, 1890. K. MIYABE).—Prov. Oshima: Zenikamezawa (III. Nov. 12, 1900. T. KAWAKAMI).—Prov. Kitami: Rishiri-Island (III. Aug. 20, 1907. M. MIURA).

Honshū.—Prov. Rikuchū: Mt. Nanshō (III. Sept. 30, 1906. G. YAMADA).—Prov. Ugo: Osaruzawa (III. Nov. 1902. Y. TOKUBUCHI).—Prov. Shimotsuke: Akanumagahara (II. & III. Aug. 11, 1891. S. HORI); Yumoto (III. Aug. 29, 1904. S. KUSANO).—Prov. Musashi: Ogikubo (III. Sept. 3, 1899. S. KUSANO; III. Nov. 5, 1899. M. SHIRAI); Shimura (III. Oct. 27, 1905. N. NAMBU).—Prov. Echigo: Suita (III. Aug. 20, 1908. S. ITŌ).

Kiushū.—Prov. Higo: Oe-mura (III. Aug. 1, 1906. K. YOSHINO).

On *Rumex domesticus* Hartm.

Saghalien.—Chipisani (I. July 16, 1906. K. MIYABE, T. MIYAKE & T. MIYAGI).

Hokkaidō.—Prov. Ishikari: Sapporo (I. June 18, 1890. Y. TOKUBUCHI; I. June 20, 1891; I. June 1897. K. MIYABE; I. June 15, 1907. S. ITŌ); Shinkotoni (I. June 3, 1900. G. YAMADA).

Honshū.—Prov. Musashi: Akabane (I. April 1900. S. KUSANO); Shimura (I. May 1, 1901. K. MIYABE).—Prov. Echigo: Nagaoka (I. June 3, 1906. M. NAKAMURA).

Distrib. Asia, Africa, Europe, America and Australia.

REMARKS. WINTER (1) was the first to study the life-history of the *Puccinia* on *Phragmites communis*. STAHL, SCHROETER and ROSTRUP

have also studied about it. This species has been a subject of considerable confusion, as it is often found mixed together with *Puccinia Magnusiana*. PLOWRIGHT, after many infection experiments during 1882-1885, proved the relation of this *Puccinia* to the *Æcidium* on *Rumex hydropathum* Huds., *R. conglomeratum* Murr., *R. obtusifolium* L., *R. crispus* L., and *Rheum officinale* Bail. And he also proved on the other hand, that the *Æcidium* on *Rumex acetosa* or *Ranunculus* *sps.* have no relation at all to this species.

Puccinia Trailii Plowr. (*Æcidium* on *Rumex acetosa*) differs from the present species only in biological characters, the teleutospores of both species being exactly the same in general morphological character.

I succeeded in infecting *Rumex domesticus* by the basidiospores of the present species.

42. *Puccinia okatamaensis* S. Itō. n. sp.—(Pl. XII. Fig. 2.)

Teleutosori, on the sheath and culm; medium or large sized, oblong or linear, often confluent, gregarious, sometimes 1.5 cm in length, naked, with torn epidermis, compact, thick, prominent, somewhat pulvinate or immersed in the tissue, black. Teleutospores, oblong or long fusiform, apex thickened (7-10 μ), apiculate or rarely rounded, base attenuated, more or less constricted at the septum, smooth, cinnamon-colored, 50-78 \times 11-20 μ ; epispore rather thick; pedicels light yellowish brown, conspicuous at the upper portion, thick, persistent, 94 μ in length.

Hab. On *Phragmites communis* Trin.

Hokkaidō.—Prov. Ishikari: Okatama (III. March 21, 1891. K. MIYABE); Ebetsu (III. April 25, 1908. S. SUWA).

Honshū.—Prov. Echigo: Okawazu (III. April 13, 1903. K. YOSHINO).—Prov. Musashi: Todahara (III. Nov. 5, 1899. T. NISHIDA).—Prov. Mino: Gifu (III. March 24, 1893. S. HORI).

Distrib. Japan.

REMARKS. The species always forms long, conspicuous, confluent sori on the sheath and culm, but not on the blade. Sometimes the sori of *Puccinia Magnusiana* are found together on the leaf blade of the same plant.

The cases of the sorus immersed in the tissue and forming a long line are not found in other related species. *Puccinia Phragmitis* forms also an elongated teleutosorus on the sheath but is not so gregarious and narrow as the present species. While comparing our plant with other species of Puc-

cinia on *Phragmites communis*, I was able to find the following differences. By its longer pedicel and larger spores, our species is distinguished from *Puccinia Magnusiana* and *P. simillima*. And from other species, our plant is easily distinguished by its narrower and cinnamon-colored spores. The basidiospores of this species have no power to infect *Rumex domesticus*.

43. *Puccinia aestivalis* Diet., in Engl., Bot. Jahrb., 34, 1905, (585); 37, 1906, (101).—(Pl. XII. Fig. 3).

Hab. On *Pollinia nuda* Trin.

Honshū.—Prov. Musashi: Tokyo (II. July 1901. G. YAMADA; III. Sept. 22, 1905. N. NAMBU).—Prov. Uzen: Ōmagari (II. & III. July 31, 1908. M. MIURA).

Distrib. Japan.

REMARKS. DIETEL (8) writes that the teleutospores germinate at once when ripe. I also recognized the same fact in our specimens. According to him its teleutospores are somewhat like those of *Puccinia Polliniae* Barcl., of Himalaya in general characters.

According to DIETEL (9), this fungus has two kinds of uredospores; one is globose or oval in shape, echinulate, with a light brownish-colored thin epispore, while the other is piriform or oval in shape, nearly smooth, and deep brown in color.

From the statement of DIETEL it seems that these two kinds of uredospores occur in separate sori; but during the course of my study, I found that both of them are formed in the same sorus.

44. *Puccinia microspora* Diet., in Engl., Bot. Jahrb., 37, 1906, (101).—(Pl. XII. Fig. 4).

Hab. On *Rottbællia compressa* L. var. *japonica* Hack.

Honshū.—Prov. Musashi: Tokyo (II. & III. Oct. 12, 1904. N. NAMBU).

Distrib. Japan.

REMARKS. I was able to examine the type specimen of this species by the kindness of Mr. N. NAMBU. The present species differs entirely, as DIETEL (9) remarked, from *Uredo Rottbælliae* and *Puccinia Rottbælliae*. Compared with *Uredo Rottbælliae*, the uredosori of our species are smaller in size, and are generally loosely covered by the epidermis, and also its uredospores are smaller with capitate paraphyses intermixed with them.

Compared with *Puccinia Rottballiæ*, our species has smaller teleutospores and subdeciduous, colored, short pedicels.

45. *Puccinia Miyoshiana* Diet., in Engl., Bot. Jahrb., **27**, 1900, (569); **28**, 1901, (283); Sacc., Syll., **16**, 1902, (311); Syd., Monogr. Ured., **1**, 1904, (809).

Syn.: *Uredo Miscanthi* P. Henn. in Schedule.

Hab. On *Spodiopogon cotulifer* Hack.

Hokkaidō.—Prov. Iburi: Chitose (II. Sept. 2, 1896. K. MIYABE).

Honshū.—Prov. Musashi: Tokyo (II. & III. Sept. 22, 1899. S. KUSANO, II. & III. Aug. 1, 1904. N. NAMBU).—Prov. Awa: Fura (II. July 29, 1893. K. MIYABE).—Prov. Echigo: Tohō (II. & III. Aug. 12, 1908. S. ITŌ).

Shikoku.—Prov. Tosa: Kamo-mura (II. June 1901. T. YOSHINAGA); Anamae-mura (II. Oct. 1904. T. YOSHINAGA).

Kiushū.—Prov. Hizen: Saga (II. Sept. 16, 1907. K. YOSHINO).

On *Spodiopogon sibiricus* Trin.

Honshū.—Prov. Musashi: Tokyo (III. Oct. 1903; II. Aug. 15, 1904. S. KUSANO; III. Sept. 1904. M. SHIRAI).

Kiushū.—Prov. Higo: Mt. Aso (II. Aug. 1901. T. KAWAKAMI).

Distrib. Japan and Siberia.

REMARKS. DIETEL (3) described this species from the specimens collected at the Tokyo Botanic Garden in 1898 by Prof. MIYOSHI, and he fully discussed its distinctive features from *Puccinia Eulaliæ*, *P. Polliniæ* and *P. subnitens*.

Uredo Miscanthi P. Henn. ought to be referred to here. P. HENNIGS gave, although it has not yet been published, the above name to a *Uredo* on *Spodiopogon cotulifer* Hack. (= *Miscanthus cotulifer*) which was sent him by Mr. T. YOSHINAGA. On examining the original specimen of *Uredo Miscanthi*, I came to the conclusion that it is nothing but the uredostage of our *Puccinia Miyoshiana*.

46. *Puccinia Stipæ-sibiricæ* S. Itō. n. sp.—(Pl. XII. Fig. 5).

Teleutosori, amphigenous, mostly epiphyllous; small, oblong or roundish, densely scattered over the surface, arranged in lines, sometimes confluent, naked, with torn epidermis, pulvinate, conspicuous, brownish black. Uredospores are frequently mixed in the sori.

Uredospores, ellipsoidal to globose, densely echinulate, $16-22 \times 15-18\mu$; epispore thick (about 2μ), yellowish or brownish-colored; germ-pores 4, scattered.

Teleutospores, clavate or oblong-clavate, apex acutely conical or rounded, thickened ($6-12\mu$), rarely not thickened, slightly or markedly constricted at the septum, chestnut-brown, somewhat lighter colored at apex, $30-58 \times 16-22\mu$; pedicels hyaline or subhyaline, as long as the spores or 80μ in length, persistent. Mesospores occasionally mixed in the sori.

Hab. On *Stipa sibirica* Lam.

Hokkaidō.—Prov. Ishikari: Sapporo (III. Oct. 4, 1894; III. Sept. 1895. K. MIYABE; III. Oct. 1, 1896. Y. TOKUBUCHI).—Prov. Iburi: Chitose (III. Oct. 10, 1900. G. YAMADA).

Distrib. Japan.

REMARKS. There are many species of *Puccinia* already known to be parasitic on *Stipa*. They are:—*Puccinia graminella* (Speg.) Diet. et Holw., *P. graminella* var. *chilensis* Neger., *P. graminella* var. *Neesiana* Speg., *P. stipæ* (Opiz.) Arth., *P. flavescens* McAlp., *P. Burnetti* Griff., *P. substerilis* Ell. et Ev., and *P. wolgensis* Nawasch. Among them there are no species which are known to infect *Stipa sibirica*. The uredospores of this species is very small in size. *Puccinia Stipæ* approaches it in the point of smallness of the uredospore. But they differ from each other in the position of the teleutostori, and in the length of the teleutospore and its pedicel. The length of teleutospore in ours is longer, while that of pedicel is considerably shorter. From other species, the present fungus differs so evidently that there is no need of stating the differences between them.

47. *Puccinia Zoysiaë* Diet., in Engl., Bot. Jahrb., **32**, 1903, (48); Sydow, Monogr. Ured., **1**, 1904, (833); Sacc., Syll., **17**, 1905, (375).

Syn.: *Uredo Zoysiaë* P. Henn. in Schedule.

Hab. On *Zoysia pungens* Willd. var. *japonica* Hack.

Honshū.—Prov. Rikuchū: Inzan-mura (III. June 29, 1897. Y. TAKAHASHI); Morioka (II. & III. Sept. 23, 1905; III. Nov. 1907. G. YAMADA; II. July 28, 1907. M. MIURA).—Prov. Mutsu: Komaki (III. Oct. 4, 1895. K. SENGOKU).—Prov. Musashi: Tokyo (III. Nov. 7, 1899; II. & III. Aug. 12, 1904. S. KUSANO).—Prov. Echigo: Mt. Sugana (III. July 11, 1905. T. KURIHARA).—Prov. Ōmi: Naimura (III. April 11, 1899. T. NISHIDA).

Shikoku.—Prov. Tosa: Kōchi (II. June 1901; III. Dec. 1907. T. YOSHINAGA).

Kiushū.—Prov. Higo: Imizu-mura (II, July 4, 1905. K. YOSHINO).

Distrib. Japan.

REMARKS. This is the only species of *Puccinia* on *Zoysia* hitherto known. DIETEL (6) states that his description of the uredospore is not complete being unable to get a good specimen. I shall note my own observation on the uredostage of this fungus in the following paragraph.

Uredosori, mostly epiphyllous; minute, oblong or linear, gregarious, often confluent, naked, with ruptured epidermis, pulverulent, light orange-colored. Uredospores, oblong, obovate or broadly ellipsoidal, verrucoso-echinulate, light yellow or hyaline, $18-22 \times 15-17\mu$; germ-pores 2, inconspicuous; epispore thick, especially at the apex; paraphyses absent in the sori.

Previous to DIETEL'S description, a specimen of the same species, collected by Mr. T. YOSHINAGA in 1901, was sent to P. HENNINGS. The author named it *Uredo Zoysiæ* P. Henn., although its description seems never to have been published. Examining the original specimen of *Uredo Zoysiæ* P. Henn., I see no points of difference from our present species.

Puccinia on *Bambuseæ*.

48. *Puccinia Phyllostachydis* Kusano, in Bull. Coll. Agric. Tokyo Imp. Univ., **8**, 1908, (2).

Hab. On *Phyllostachys bambusoides* S. et Z.

Honshū.—Prov. Musashi: Tokyo (II. & III. March 2, 1903; II. & III. March 5, 1903. S. KUSANO).—Prov. Yamashiro: Kyoto (II. June 12, 1895. N. HIRATSUKA; II. July 14, 1895. T. TAKAHASHI).

On *Phyllostachys bambusoides* S. et Z. var. *aurea* Makino.

Honshū.—Prov. Musashi: Tokyo (II. & III. March 5, 1903; II. & III. March 20, 1903. S. KUSANO; II. Aug. 1893. K. MIYABE).

On *Phyllostachys bambusoides* S. et Z. forma *Kashirodake* Makino.

Honshū.—Prov. Musashi: Tokyo (II. & III. March 27, 1903. S. KUSANO).

Distrib. Japan.

REMARKS. The macroscopical appearance of this species agrees with that of other *Puccinia* on *Bambuseæ*. But its paraphyses are very characteristic being often septate and thick walled. The teleutospores which are not so much thickened at apex, can be distinguished from those of *Puccinia Kusanoi* and *P. xanthosperma*. The length of pedicel of this fungus is

longer than that of *P. melanocephala* Syd. (about ten times), although it approaches in the slight thickening on its apex. Moreover, the presence of the paraphyses distinguishes this species from *Puccinia Arundinariæ*.

Prof. KUSANO (3) described this species in 1908 and he remarked that it is confined to four forms of *Phyllostachys bambusoides*: namely *Phyllostachys bambusoides* and var. *aurea*, *Marliacea*, and forma *Kashirodake*, but not to any other species of this genus.

49. *Puccinia Kusanoi* Diet., in Engl., Bot. Jahrb., **27**, 1900, (568); P. Henn., in Engl., Bot. Jahrb., **28**, 1901, (261); **31**, 1902, (731); Sacc., Syll., **16**, 1902, (309); Sydow, Monogr. Ured., **1**, 1904, (732); Kusano, Bull. Coll. Agric. Tokyo Imp. Univ., **8**, 1908, (5).

Syn.: *Uredo Arundinariæ* Syd., in Hedw., **37**, 1898, ([208]); Sacc., Syll., **14**, 1892, (406).

Hab. On *Arundinaria Simoni* Riv.

Honshū.—Prov. Mutsu: Goshogawara (II. Nov. 1904. T. KASHIWA).—Prov. Ugo: Akita (II. & III. Nov. 1903. Y. TOKUBUCHI).—Prov. Iwashiro: Mt. Shinobu (II. & III. June 15, 1903. T. MIYAKE).—Prov. Shimōsa: Chiba (III. Jan. 1, 1896. K. SENGOKU).—Prov. Musashi: Tokyo (III. April 30, 1883. K. ŌMURA; II. Sept. 1889. K. MIYABE; II. & III. March 19, 1891; II. Oct. 15, 1891. S. HORI; II. & III. Nov. 25, 1895; III. Jan. 14, 1896. K. SENGOKU; III. April 24, 1900. T. NISHIDA); Ōmiya (III. Oct. 1886. Y. ICHIKAWA).—Prov. Sagami: Hakone (III. April 1891. S. HORI; II. & III. April 12, 1901. K. MIYABE).—Prov. Mino: Mt. Kinkwa (II. & III. Dec. 3, 1898; Y. TOKUBUCHI); Gifu (II. & III. Oct. 1889. Y. TOKUBUCHI).—Prov. Settsu: Osaka (II. & III. 1903. A. IDETA).—Prov. Tsushima: Izuhara (II. Aug. 1901. K. YABE).

On *Arundinaria Simoni* Riv. var. *Chino* Mak.

Honshū.—Prov. Ugo: Akita (II. & III. 1896. T. YOSHINO).—Prov. Musashi: Tokyo (II. & III. June 5, 1899. S. KUSANO; II. July 21, 1899. Y. TOKUBUCHI; II. Aug. 11, 1900. G. YAMADA; III. Feb. 2, 1902. K. YOSHINO; II. & III. March 26, 1902. N. NAMBU).—Prov. Rikuchū: Sendai (II. Oct. 5, 1895. K. SENGOKU).—Prov. Izu (III. May 1898. M. SHIRAI).—Prov. Sagami: Odawara (III. Jan. 13, 1898. K. MIYABE).

Kiushū.—Prov. Higo: Mt. Kinkwa (III. June 14, 1906. K. YOSHINO).

On *Arundinaria Simoni* Riv. var. *variegata* Hack.

Kiushū.—Prov. Higo: Ōe-mura (II. Oct. 3, 1905. K. YOSHINO).

On *Arundinaria Narihira* Mak.

Honshū.—Prov. Musashi: Tokyo (III. May 5, 1903. S. KUSANO).

On *Arundinaria Narihira* Mak. forma *Yashadake* Mak.

Honshū.—Prov. Musashi: Tokyo (III. May 3, 1903. S. KUSANO).

On *Arundinaria variabilis* Mak. var. *viridi-striata* Mak.

Honshū.—Prov. Musashi: Tokyo (II. 1897. M. MIYOSHI).

Shikoku.—Prov. Tosa: Sakawa (II. May 1900. T. YOSHINAGA).

On *Arundinaria variabilis* Mak. forma *foliis glabris* Mak.

Honshū.—Prov. Musashi: Tokyo (II. July 21, 1895. Y. TAKAHASHI).

On *Arundinaria variabilis* Mak, forma *foliis pubescentibus* Mak.

Honshū.—Prov. Mutsu: Hirosaki (II. & III. Oct. 26, 1896. N. HIRATSUKA).—Prov. Iwaki: Shiraishi (II. Aug. 1, 1895. Y. TAKAHASHI).—Prov. Owari: Nagoya (II. June 19, 1895. Y. TAKAHASHI)

On *Sasa nipponica* Mak. et Shib.

Honshū.—Prov. Mutsu: Hirosaki (III. April 1897. N. HIRATSUKA); Asagishi-mura (III. Nov. 7, 1897. Y. TAKAHASHI).—Prov. Rikuchū: Sannozan (III. May 13, 1893. Y. TAKAHASHI); Morioka (II. & III. May 17, 1903; II. & III. March 13, 1904. G. YAMADA; II. Sept. 23, 1904. K. SAWADA).

Distrib. Japan.

REMARKS. In 1898, SYDOW (1) described the uredostage of this fungus by the specimen of *Arundinaria Fortunei* var. *aurea* under the name of *Uredo Arundinariæ*. In 1900, DIETEL (3) gave the present name, describing the teleutostage on *Arundinaria Fortunei* and *A. Simoni*.

This species differs from *Puccinia longicornis* in the absence of paraphyses in the uredosori and also in the shape of the apex of teleutospores. In regard to the latter character, however, the transitional forms are occasionally found between *Puccinia Kusanoi* and *P. longicornis*. I found among the teleutospores of the present species some having even an apex 18μ thick; while on the other hand, among *Puccinia longicornis* there are some only 8μ thick at the apex.

The present species is more common in Japan than the other species of *Puccinia* growing on *Bambuseæ* and the number of its host-plants are also more numerous.

50. Puccinia Kusanoi Diet. var. **Azuma** Kusano., in Bull. Coll. Agric. Tokyo Imp. Univ., **8**, 1908, (8).

Hab. On *Sasa ramosa* Mak. et Shib.

Honshū.—Prov. Iwaki: Sōma (II. & III. April 1903. S. KUSANO).

Distrib. Japan.

REMARKS. Prof. KUSANO (3) described this variety of *Puccinia Kusanoi*, distinguishing it from the typical form by the longer teleutospores and by the presence of less constriction at septum. With the exception of the shape

of the thickened apex, the general form of the spore approaches rather near to *Puccinia longicornis* than to *Puccinia Kusanoi*, as has already remarked by Prof. KUSANO.

I have also found mixed in one and same sorus of the variety some teleutospores closely resembling the typical spores of *Puccinia Kusanoi*.

51. *Puccinia longicornis* Pat. et Har., in Bull. Soc. Myc. France, 7, 1891, (143); Sacc., Syll., 11, 1895, (200); Dietel, in Engl., Bot. Jaharb., 27, 1900, (568); 37, 1906, (102); Sydow, Monogr. Ured., 1, 1904, (734); Kusano, Bull. Coll. Agric. Tokyo Imp. Univ., 8, 1908, (4).

Hib. On *sasa paniculata* Mak. et. Shib.

Hokkaidō.—Prov. Ishikari: Mt. Sankaku (III. May 4, 1902. T. MIYAKE); Sapporo (III. May 5, 1908. M. KASAI; III. May 7, 1908; III. May 18, 1909. S. ITŌ).—Prov. Shiribeshi: Yoichi (II. & III. May 14, 1908. M. KASAI).

Honshū.—Prov. Mutsu: Hirosaki (II. & III. July 18, 1896. K. KIKUCHI); Goshogawara (II. Sept. 1904. T. KASHIWAI); Hachinohe (III. April 28, 1905. G. YAMADA).—Prov. Echigo: Fukudomura (III. April 13, 1903. K. YOSHINO).—Prov. Musashi: Tokyo (II. Oct. 15, 1891. S. HORI; III. Feb. 27, 1897. M. SHIRAI; III. Nov. 25, 1898. S. KUSANO; III. 1899. M. MIYOSHI; III. March 26, 1900. T. NISHIDA; III. March 15, 1903; III. April 1907. S. KUSANO).

Kiushū.—Prov. Higo: Kumamoto (II. & III. March 12, 1905. K. YOSHINO); Kiuhonji (III. March 12, 1905. K. YOSHINO); Kurokawa (II. Aug. 13, 1906).

On *Sasa albo-marginata* Mak. et Shib,

Kiushū.—Prov. Higo: Mt. Aso (III. April 3, 1907. T. TADA).

On *Arundinaria japonica* S. et Z.

Honshū.—Prov. Musashi: Tokyo (II. & III. June 14, 1899. S. KUSANO).—Prov. Owari: Nagoya (II. July 1895. Y. TAKAHASHI).

Distrib. Japan.

REMARKS. This species is readily distinguished from *Puccinia Kusanoi*, *P. Sasa* and *P. Phyllostachyidis* by the cylindrically elongated apex of its teleutospore (13–32 μ sometimes 38 μ in length), and the presence numerous clavate paraphyses in the uredosori. By DIETEL (9), this species is recorded as parasitic on *Phyllostachys bambusoides* S. et Z. (= *P. Quilici* Riv.), collected by Mr. YOSHINAGA in Shikoku. From my own observation, the fungus does not attack any species of *Phyllostachys*.

52. *Puccinia mitriformis* S. Itō. n. sp.—(Pl. XII. Fig. 6).

Teleutosori, hypophyllous; large, roundish, scattered or subgregarious,

not confluent, naked, pulvinate, prominent, compact, thick, sooty-black or brownish-black. Teleutospores, oblong-clavate or fusiform, apex extraordinarily conically elongated ($36-84\mu$, sometimes 90μ in length), subacute, base somewhat attenuated, not or slightly constricted at the septum, smooth, light yellowish-orange or whitish-yellow, hyaline or lighter colored at the tip of apex, $80-130 \times 18-23\mu$; pedicels hyaline, fine, extraordinarily long, ($100-240\mu$, sometimes 280μ), slender, subdeciduous. Mesospores are frequently mixed in the sori.

Hab. On *Sasa paniculata* Mak. et Shib.

Honshū.—Prov. Rikuchū: Dainoyu (III. April 25, 1907. G. YAMADA).

Distrib. Japan.

REMARKS. The species of *Puccinia* hitherto known to be parasitic on the Japanese Bambuseæ are *Puccinia Kusanoi*, *P. Phyllostachydis*, *P. longicornis* and *P. Sasæ*. A fifth species is here added, based on the specimen obtained from Prof. G. YAMADA. It grows on *Sasa paniculata*. At first sight it is quite indistinguishable from *Puccinia longicornis* macroscopically. It is only when examined under a microscope, that these two species are distinguishable from each other. The apex of the teleutospore of the present species is conically elongated reaching nearly 90μ in length, while that of *Puccinia longicornis* is cylindrically elongated attaining about 38μ in its maximum length. Moreover, the teleutospores of the former species are slightly constricted at the septum, with extremely long slender subdeciduous pedicels, and also with many mesospores intermixed. I regard this fungus for the above mentioned reasons as a new species. The uredostage of this fungus is not yet obtained.

53. *Puccinia Sasæ* Kusano, Bull. Coll. Agric. Tokyo Imp. Univ., **8**, 1908, (9).

Hab. On *Sasa borealis* Mak. et Shib.

Distrib. Japan.

REMARKS. This species was described by Prof. KUSANO from the specimen collected at Nikko by Mr. T. MAKINO. This species is said to resemble *Puccinia Phyllostachydis* in general appearance, but it differs in the upper cell being wider and shorter than the lower, and also in its para-

physes being not septated. Moreover, the uredospore of the present species is the largest in the species of *Puccinia* growing on *Bambuseæ*.

Uredostage only, found in Japan.

54. *Puccinia Agrostidis* Plowr., in Bot. Chron., **8**, 1890, (139); Sacc., Syll., **11**, 1895, (202); Sydow, Monogr. Ured., **1**, 1904, (717); Fischer, Ured. Schw., 1904, (353); McAlpine, Rusts of Australia, 1906, (114).

Hab. On *Agrostis perennans* Tuck.

Hokkaidō.—Prov. Ishikari: Ebetsu (II. Sept. 29, 1907. S. Itō).

Distrib. Europe, Japan, Siberia, India and Australia.

REMARKS. Our specimen has only the uredostage. A hyaline epispore as well as general shape and size of the spore point to its identity with *Puccinia Agrostidis*. But as there are no records about the number of germ-pores of *Puccinia Agrostidis*, the exact identification is somewhat difficult. In ours there are 4–6 germ-pores.

This fungus forms its *Æcidium* on the species of *Aquilegia* in Europe; but in our country, *Æcidium* on *Aquilegia* is not yet found.

55. *Puccinia Baryi* (Berk. et Br.) Wint., Pilze, 1884, (178); Sacc., Syll., **7**, 1888, (660); Plowr., Brit. Ured. & Ustil., 1889, (191); Schroeter, Pilz Schles., 1889, (338); P. Henn., in Engl., Bot. Jahrb., **31**, 1902, (732); **34**, 1905, (596); Sydow, Monogr. Ured., **1**, 1904, (737); Fischer, Ured. Schw., 1904, (369).

Hab. On *Brachypodium silvaticum* Beauv.

Hokkaidō.—Prov. Ishikari: Shiroishi (II. Oct. 6, 1907. S. Itō).—Prov. Iburi: Mororan (II. Aug. 3, 1900. G. YAMADA).—Prov. Kitami: Rishiri-Island (II. Sept. 1, 1899. T. KAWAKAMI).

Honshū.—Prov. Musashi: Takaoyama (II. July 25, 1901. N. NAMBU).

Distrib. Europe, Japan and India.

REMARKS. The teleutostage of this fungus has not yet been found in our country. Consequently, it is somewhat difficult to settle exactly its systematic position. However, the presence of paraphyses and the character of the uredospores coincide very closely with the description of *Puccinia Baryi*.

Brachypodium silvaticum is the only plant I have examined as a host for this fungus. P. HENNINGS recorded *Brachypodium japonicum* as its host-plant.

Æcidium stage only, found in Japan.

56. *Puccinia perplexans* Plowr., Quart. Journ. Micr. Sc., **25**, 1885, (164); Brit. Ured. and Ustil., 1889, (179); Sacc., Syll., **7**, 1888, (632); Dietel, in Hedw., **28**, 1889, (278); in Engl., Bot. Jahrb., **34**, 1905, (585); Klebahn, Zeits. f. Pflanzenk., **12**, 1902, (145); Sydow, Monogr. Ured., **1**, 1904, (719).

Syn. : *Æcidium Ranunculacearum* DC., Fl. franç., **6**, (97).

Hab. On *Ranunculus acer* L. var. *Steveni* Rgl.

Saghalien.—Kshunnai (I. July 7, 1906. T. MIYAKE).

On *Ranunculus acer* L. ?

Saghalien.—Ōdomari (I. June 19, 1906. T. MIYAKE); Darny (I. June 27, 1906. T. MIYAKE).

On *Ranunculus japonicus* Langs.

Hokkaidō.—Prov. Ishikari: Sapporo (I. June 15, 1890. K. MIYABE; I. June 3, 1900. G. YAMADA); Horomui (I. June 13, 1897. G. YAMADA).

Honshū.—Prov. Musashi: Shimura (I. May 1, 1901. K. MIYABE).

Distrib. Europe and Japan.

REMARKS. In Europe, the present species produces its uredo- and teleutospores on *Alopecurus pratensis*; whose genetic relation with the *Æcidium* on *Ranunculus acer* was experimentally proved by PLOWRIGHT in 1885.

The presence of the uredo- and teleutospores of this fungus in Japan is not yet recorded. In 1905, DIETEL identified the *Æcidium* on *Ranunculus acer* var. *japonicus* as the present species from the specimen sent to him by Mr. NAMBU.

The specimens preserved in the University Herbarium are on *Ranunculus acer* var. *Steveni* and var. *japonicus*. They agree exactly in their morphological characters with the European specimens of *Puccinia perplexans*. Another form of *Æcidium* on *Ranunculus acer* in Europe was combined experimentally by SCHROETER with *Uromyces Dactylidis*. The uredo- and teleutospores of this *Uromyces* are also not yet found in our

country. The *Æcidium* of *Uromyces Dactylidis* has many points of difference when compared to our *Æcidium*. In the former species, peridia are recurved, and the walls of the peridial cells are thicker.

57. *Puccinia persistens* Plowr., Brit. Ured. and Ustil., 1889, (180); Sacc., Syll., **9**, 1891, (312); Dietel, in Engl., Bot. Jahrb., **27**, 1900, (568); **28**, 1901, (283); P. Henn., in Engl., Bot. Jahrb., **31**, 1902, (732); **34**, 1905, (596); Sydow, Monogr. Ured., **1**, 1904, (825); Fischer, Ured. Schw., 1904, (347).

Syn.: *Æcidium Thalictri-flavi* Wint., Pilze, 1889, (269).

Hab. On *Thalictrum minus* L.

Saghalien.—Mauka (I. July 5, 1906. T. MIYAKE); Mereya (I. July 14, 1906. K. MIYABE & T. MIYAGI); Chirihasan (I. July 25, 1906. K. MIYABE & T. MIYAGI); Tomarizawa (I. July 23, 1906. T. MIYAKE); Mt. Dainan, Todomoshiri (I. July 26, 1906. T. MIYAKE).

Hokkaidō.—Prov. Ishikari: Sapporo (I. June 30, 1890; I. June 26, 1891. K. MIYABE); Tsukisapp (I. June 25, 1893. T. KAWAKAMI).—Prov. Hitaka: Niikapp (I. July 13, 1907. M. KASAI).—Prov. Nemuro: Pinnetkemoi prope appid. Nemuro (I. July 5, 1909. H. TAKEDA).

Distrib. Europe, North America, Japan, Siberia and India.

REMARKS. *Æcidia* on *Thalictrum* are related to *Puccinia persistens*, *P. septentrionalis* and *P. borealis*. Our *Æcidium* coincides in all characters to those of *Puccinia persistens*. Its teleutostage is found on *Triticum repens* and *Poa nemoralis* in Europe, but it is not yet found in our country.

58. *Puccinia Festucae* Plowr., Bot. Chron., 1890, (42, 139); Klebahn, Zeits. f. Pflanzenk., **4**, 1894, (138); **5**, 1895, (150); Sacc., Syll., **11**, 1895, (194); Sydow, Monogr. Ured., **1**, 1904, (752); Fischer, Ured. Schw., 1904, (377); Dietel, in Engl., Bot. Jahrb., **37**, 1906, (102).

Syn.: *Æcidium Caprifoliacearum* DC. Fl. franç., **2**, 1815, (597).

Hab. On *Lonicera caerulea* L. var. *villosa* Torr. et Gray.

Saghalien.—Chirihasan (I. July 25, 1906. K. MIYABE & T. MIYAGI).

Kurile-Island.—(I. Aug. 1884. K. MIYABE).

Hokkaidō.—Prov. Kitami: Rishiri-Island (I. Aug. 1, 1899. W. HIROSE & T. KAWAKAMI).

On *Lonicera Chamissoni* Bge.

Saghalien.—Dubki (I. July 22, 1905. K. MIYABE & T. MIYAGI); Chirihasan (I. July 25, 1906. K. MIYABE & T. MIYAGI); Higashiyama (I. Aug. 28, 1906. T. MIYAKE); Korsakoff (I. Aug. 4, 1906. K. MIYABE & T. MIYAGI); Shikka (I. Aug. 12, 1906. T. MIYAKE).

On *Lonicera chrysantha* Turcz.

Saghalien.—Mereya (I. July 14, 1906. K. MIYABE, T. MIYAKE & T. MIYAGI).

On *Lonicera Glehni* Fr. Schm.

Saghalien.—Korsakoff (I. July 12, 1906. K. MIYABE & T. MIYAGI).

On *Lonicera Maximowiczii* Rupr.

Saghalien.—Dubki (I. July 22, 1906. K. MIYABE & T. MIYAGI).

Distrib. Europe, North America and Japan.

REMARKS. DIETEL (9) recorded for the first time the presence of the *Æcidium* stage of this species on *Lonicera emphyllocalyx* (= *L. cærulea* var. *villosa*?) which was collected by Prof. YENDO in 1903 in the Kurile-Islands. The same *Æcidium* was collected on *Lonicera cærulea* var. *villosa* by Prof. MIYABE in 1884 also in the Kuriles. It was also abundantly collected in Saghalien on different species of *Lonicera* by Prof. K. MIYABE, Messrs. T. MIYAKE and T. MIYAGI.

In the last summer, I found a uredo growing on *Festuca ovina* in Prov. Echigo. It resembles very closely the uredospore of *Puccinia Festucæ*.

59. Puccinia Agropyri Ell. et Ev., in Journ. of Mycol., **7**, 1892, (131); Sacc., Syll., **11**, 1895, (201); Dietel, in Engl., Bot. Jahrb., **27**, 1900, (568); **32**, 1903, (625); **37**, 1906, (102); P. Henn., in Engl., Bot. Jahrb., **31**, 1902, (731); Klebahn, Wirtswechs. Rostpilze, 1904, (292); Sydow, Monogr. Ured., **1**, 1904, (823); Fischer, Ured. Schw., 1904, (350); McAlpine, Rusts of Australia, 1906, (113).

Syn. : *Æcidium Clematidis* DC. Fl. franç., **2**, 1815, (243).

Hab. On *Clematis paniculata* Thunb.

Hokkaidō.—Prov. Oshima: Satsukari (I. July 13, 1893. K. MIYABE); Okushiri (I. July 27, 1890. K. MIYABE); Esashi (I. Aug. 10, 1900; I. Aug. 18, 1902. G. YAMADA).

Honshū.—Prov. Owari: Chita (I. May 2, 1899. Y. TOKUBUCHI).—Prov. Harima: Himeji (I. May 8, 1899. Y. TAKAHASHI).

Shikoku.—Prov. Tosa: Nozu-mura (I. May 1901. T. YOSHINAGA).

Kiushū.—Prov. Hizen: Fukuda (I. May 8, 1896. G. KUROSAWA).

On *Clematis apiifolia* DC.

Honshū.—Prov. Rikuchū: Kuroishino (I. July 5, 1903. G. YAMADA); Takizawa (I. July 15, 1903. G. YAMADA); Morioka (I. June 20, 1897. G. YAMADA; I. July 15, 1903. S. ARIMOTO).

On *Clematis fusca* Turcz.

Hokkaidō.—Prov. Ishikari: Horomui (I. July 9, 1896. J. KASAHARA; I. July 20, 1900. G. YAMADA).

Distrib. Europe, America and Japan.

REMARKS. The teleutostage of this fungus is found on *Agropyrum glaucum*, *A. junceum* and *A. occidentale* in Europe and America; but it is not yet collected in our country. The æcidial stage is commonly found in different places of our country.

DIETEL (3) after examining the Japanese specimens identified them as the *Æcidium* stage of *Puccinia Agropyri*. I have also carefully compared our *Æcidium* with American specimens of *Æcidium Clematidis*, and have noticed no differences between them.

DIORCHIDIUM Kalchb.

1. *Diorchidium levigatum* Syd. et Butl., in Ann. Mycol., 5, 1907, (500).—(Pl. XII. Fig. 7).

Uredosori, amphigenous, mostly epiphyllous; minute, oblong or roundish, on the brownish or blackish discolored spots, scattered or gregarious, rarely confluent, loosely covered by epidermis or naked, pulverulent, somewhat pulvinate, dark yellowish-brown. Uredospores, broadly ellipsoidal, subglobose or globose, densely echinulate (distances between spines about $2-3\mu$), $24-30 \times 18-25\mu$; epispore brownish yellow, $2-3\mu$ thick; germ-pores 2, equatorial, inconspicuous; paraphyses absent in the sori.

Hab. On *Oplismenus compositus* Beauv.

Loochoo.—Shuri (II. & III. Nov. 27, 1898. N. HIRATSUKA).

Formosa.—Daihoku (II. Nov. 17, 1906. T. KAWAKAMI & R. SUZUKI).

Distrib. India and Japan.

REMARKS. The species belonging to this genus are generally found in the tropical or subtropical regions of Asia, Africa and America. The total number of the species is not abundant.

In Japan, the presence of the species of this interesting genus have remained unknown up to this time. We have in our University Herbarium, two specimens of the present species collected in Formosa and Loochoo on *Oplismenus compositus*. Our species coincides exactly to the description of the fungus by SYDOW and BUTLER (2) in the characters of teleutospores.

The authors did not describe the uredostage of this fungus, which I take pleasure in supplementing in this paper.

STEREOSTRATUM Magnus.

1. *Stereostratum corticioides* (Berk. et Br.) P. Magnus, in Ber. Deutsch. Bot. Ges., **17**, 1899, (178).

Syn.: *Puccinia corticioides* Berk. et Br., in Journ. of Linn. Soc., **16**, 1877, (52); Sacc., Syll., **7**, 1888, (731); Dietel, in Engl., Bot. Jahrb., **27**, 1900, (283); P. Henn., in Engl., Bot. Jahrb., **28**, 1901, (262); **31**, 1902, (731); Hori, Bot. Mag. Tokyo., **6**, 1892, (211); in Yatabe, Icon. flor. Jap., **1**, 1892, (143); Massee, in Grev., **22**, 1893/94, (18); Sydow, Monogr. Ured., **1**, 1904, (847).

Puccinia Schotmülleri P. Henn., in Hedw., **32**, 1893, (61); Sacc., Syll., **11**, 1899, (200).

Hab. On *Arundinaria Simoni* Riv.

Honshū.—Prov. Settsu: Kōbe (III. April 28, 1875. Challenger exp.).—Prov. Musashi: Tokyo (III. March 9, 1891; III. 1895. S. HORI; III. May 10, 1902. T. NISHIDA; II. May 1904. S. KUSANO); Horinouchi (III. April 15, 1894. S. MATSUDA).

Kiushū.—Prov. Chikuzen: Kasuya-gun (III. April 19, 1905. K. YOSHINO).

On *Arundinaria Simoni* Riv. var. *Chino* Mak.

Kiushū.—Prov. Hizen: Kumamoto (III. April 27, 1905. K. YOSHINO); Prov. Hizen: Itoshima-gun (III. April 20, 1905. K. YOSHINO); Fujitsu-gun (III. April 23, 1905. K. YOSHINO).

On *Phyllostachys bambusoides* S. et Z.

Kiushū.—Prov. Hizen: Wakasugi (III. April 19, 1905. K. YOSHINO); Kasuya-gun (III. April 19, 1905. K. YOSHINO).

On *Phyllostachys puberula* Munro.

Kiushū.—Prov. Higo: Ōe-mura (III. Feb. 3, 1905. K. YOSHINO).

On *Sasa albo-marginata* Mak. et Shib.

Kiushū.—Prov. Higo: Mt. Aso (III. April 3, 1907. T. TADA).

Distrib.—Japan.

REMARKS. The present species was first collected by a botanist in the Challenger expedition at Kōbe in 1875. The specimen was sent to BERKELEY for identification. He described it in cooperation with BROOME under the name of *Puccinia corticioides* in the Journal of the Linnean Society (1). But to them its uredostage was not known. In 1892, Mr. HORI (1. 2.) found.

that the duration of the teleutostage begins from September and lasts to the end of April, while that of the uredostage ranges from April to September. The author described accurately the characters of the uredospores. He further remarked about the variability in the shape of the teleutosorus and in the length of the pedicel of the teleutospore. The length of the pedicel differs according to the position of the spores. When they are situated in the middle part of the sorus, the length of the pedicel often reaches to 1 mm.

In 1893, P. HENNINGS (1) described the present fungus as a new species under the name of *Puccinia Schottmülleri* from the specimen collected by OTTO SCHOTTMÜLLER in Nagasaki, in 1861, on *Bambusa* sp. In 1894, G. MASSEE (1) observed that *Puccinia Schottmülleri* of P. HENNINGS is nothing but *Puccinia corticioides* of BERKELEY and BROOME. In 1901, P. HENNINGS (3) retracted the name of *Puccinia Schottmülleri*.

Before that time, in 1899, P. MAGNUS (1) proposed to found on it a new genus *Stercostratum*. He distinguished it from *Puccinia* by a hyaline or light colored epispore, by the number of germ-pores and by the peculiar character of the sorus of the teleutospores. The author noted its relations to *Gymnosporangium*, which it resembles in the hyaline wall and the shape of sorus, but it differs in the non-gelatinous character of the pedicel.

In 1875, SCHROETER established a new genus *Uropyxis*, laying importance on the presence of two or more germ-pores in each cell of the teleutospore. Our species may be included in *Uropyxis*, considering from the presence of two germ-pores and of thin hyaline membrane only, but the *Stereum*-like form of its sorus prevents us from doing so.

In 1904, SYDOW (2) remarked that *Stereostratum* ought to be included in the *Uropyxis* series of *Puccinia*.

Based on my personal observations of many specimens (1) I am inclined to accept the view of P. MAGNUS in considering our species as a type of a new genus *Stereostratum*. (2) The host-plant is not limited to *Arundinaria Simoni* as has hitherto been considered, but *Phyllostachys bambusoides*, *P. puberula* and *Sasa albo-marginata* are also to be counted as its host-plants.

ROSTRUPIA Lagerh.

1. **Rostrupia Elymi** (West.) Lagerh. in Journ. de Bot., **3**, 1889, (185); Sacc., Syll., **9**, 1891, (316).

Syn. : *Puccinia Elymi* West., in Bull. Brux., 1851, (408); Sacc., Syll., **7**, 1888, (656).

Puccinia triarticulata Berk. et Cult., North Pacific Exped. n. 130; Sacc., Syll., **7**, 1888, (732).

Hab. On *Elymus arenarius* L.

Hokkaidō.—Prov. Kitami: Oshidomari (III. July 21, 1899. T. KAWAKAMI); Kutsugata (II. & III. Sept. 2, 1899. T. KAWAKAMI); Wakkanai (II. & III. Aug. 17, 1894. K. MIYABE); Rebun-Island (III. Aug. 23, 1894. K. MIYABE); Rishiri-Island (II. & III. Aug. 20, 1907. M. MIURA).—Prov. Shiribeshi: Shiribetsu (II. & III. July 28, 1897. G. YAMADA); Kitamura (III. Sept. 1, 1905. K. MIYABE).—Prov. Iburi: Mororan (III. Aug. 3, 1900. G. YAMADA).

On *Elymus sibiricus* L.

Hokkaidō.—Prov. Shiribeshi: Shikuzushi (III. Oct. 7, 1897. K. MIYABE).—Prov. Kitami: Rishiri-Island (II. & III. Aug. 20, 1907. M. MIURA).

Distrib. Europe, North America and Japan.

REMARKS. The present genus was found by LAGERHEIM in 1889 after the name of the eminent mycologist, E. ROSTRUP.

We have in Japan three species of this genus; viz., *Rostrupia Dioscoree* Kom., *R. Elymi* and *R. Miyabeana* n. sp.

In 1851, WESTEND described for the first time *Puccinia Elymi* on *Elymus arenarius*. When comparing our species with the descriptions of the fungus, I have found two points of difference. 1. The positions of the uredosori and teleutosori are just reverse to the descriptions. 2. The teleutospores are one septated and are provided with hyaline pedicels, while in our cases they are many septated and furnished with colored pedicels.

The description of *Puccinia triarticulata* on *Elymus mollis*, collected on the American side of the Behring strait by CHARLES WRIGHT, is too brief to identify our plant with it. But from the characters there given and the relation of the localities, our fungus may safely be regarded as the same species as the Behring plant.

In 1889, LAGERHEIM united them under the present name. The fungus

is commonly found on the leaves of *Elymus arenarius*, but is also rarely found on *Elymus sibiricus* in Hokkaidō.

2. *Rostrupia Miyabeana* S. Itō. n. sp.—(Pl. XII. Fig. 8).

Uredosori, amphigenous, mostly epiphyllous; small, oblong or elliptical, scattered or gregarious, on the brownish discolored spots, naked, with torn epidermis, pulverulent, orange-colored. Uredospores globose, subglobose or broadly ellipsoidal, echinulate, $18-28 \times 14-16\mu$; episore $1-2\mu$ or 3μ thick, hyaline or subhyaline; paraphyses absent.

Teleutosori, hypophyllous or on the sheath; small, oblong or sublinear, scattered or subgregarious, long covered by the epidermis, sometimes confluent, somewhat pulvinate, black; separated into small compartments by the thick bed of brown paraphyses. Teleutospores cylindrical or oblong-clavate, apex slightly thickened ($3-5\mu$), truncate or obliquely pointed, rarely rounded, base attenuated or rounded, not or very slightly constricted at the septum, 2-4 septated, smooth, blackish ferruginous, darker colored at apex, $32-52 \times 15-24\mu$; pedicels short, brown, subdeciduous.

Hab. On *Brachypodium japonicum* Miq.

Hokkaidō.—Prov. Oshima: Hakodate (II. & III. July 1897. T. KAWAKAMI).

Kiushū.—Prov. Higo: Imizu-mura (III. June 9, 1904; II. Feb. 12, 1905. K. YOSHINO).

On *Brachypodium pinnatum* Beauv.

Hokkaidō.—Prov. Ishikari: Umon (III. Aug. 11, 1891. K. MIYABE).

Distrib. Japan.

REMARKS. The case of *Rostrupia* parasitic on the leaves of *Brachypodium* has hitherto not been recorded. In our specimen, it is true that the two-celled teleutospores are often found mixed, but the three-celled ones are far more common. The four-celled ones are comparatively few in number.

The length of the teleutospore of this fungus is shorter than that of *Rostrupia Elymi*, but its breadth is generally wider. Its color differs from that of the latter species being darker and the lowest septum is sometimes longitudinal or oblique.

UREDO Pers.

A. Paraphyses absent in the sori.

1. *Uredo Rottbælliæ* Diet., in Engl., Bot. Jahrb., **32**, 1903, (52); **34**, 1905, (591); Sacc., Syll., **17**, 1905, (457).—(Pl. XII. Fig. 9).

Hab. On *Rottbællia compressa* L. var. *japonica* Hack.

Honshū.—Prov. Musashi: Tokyo (II. June 22, 1896; II. Oct. 20, 1896. S. HORI; II. Oct. 23, 1899. N. NAMBU; II. Nov. 25, 1899. T. NISHIDA).

Distrib. Japan.

REMARKS. SYDOW (2) suggested that this *Uredo* might belong to *Puccinia Rottbælliæ* Syd.

In 1902, ARTHUR (3) made this species synonymous to *Uromyces Rottbælliæ* Arth. of Himalaya.

In 1906, MCALPINE (1) writes of the present species as synonymous to *Puccinia cacao* McAlp. of Australia, after the determination by DIETEL.

In our country as its teleutostage is not yet known, it is still under question, whether our species belong to *Uromyces Rottbælliæ*, or to *Puccinia cacao* or to *Puccinia Rottbælliæ*. But one fact is certain that our species has no amphispores, of which ARTHUR (5) writes in the case of his *Uromyces Rottbælliæ*. In short, it seems to me safe in the present case to treat the present species as *Uredo Rottbælliæ*.

2. *Uredo Kühnii* (Krüg.) Wak. et Went., De Ziekten van het Suikerriet op Java, 1898, (144).

Syn.: *Uromyces Kühnii* Krüg., Bericht Zuck. West-Java, 1890, (117); Sacc., Syll., **11**, 1895 (182).

Hab. On *Saccharum officinarum* L.

Formosa.—Daihoku (II. Nov. 20, 1906. T. KAWAKAMI).

Distrib. Japan, India, Java and Australia.

REMARKS. The present fungus was first described by KRÜGER (1) under the name of *Uromyces Kühnii*, which he had found parasitic on the leaves of suger cane in Java together with *Cercospora Vagina* Krüg.

Later, WAKKER and WENT (1) proved by the infection experiments, that the fungus lacks entirely the teleutostage and gave it the present name.

Moreover, they observed that the fungus also attacks the wild sugar cane (*Saccharum spontaneum*) in Java as well as in Australia.

In 1906, SYDOW and BUTLER (1) identified the Indian fungus on *Saccharum arundinacea*, *S. fusca* and *S. spontaneum* with the present species, and remarked that the uredospore on the last named host-plant differs from the rest by having a thickened apex.

Our specimens on *Saccharum officinarum* from Formosa, as WAKKER and WENT remarked, have the sori mostly on the leaf-blade. Macroscopical appearance also agrees with the description of these authors. They recorded the sori, however, as amphigenous, saying that those on the under surface of the leaves are more than those on the upper surface. But I have not been able to find in the Formosan specimens even a sorus on the upper surface.

I found two kinds of spores in the same uredosori. The one kind is the uredospores with equally thickened hyaline wall, and the another is those with a wall thickened especially at the apex and with brownish-yellow episporium. It is very probable that the latter sort of the spores might probably have led KRÜGER to consider this fungus to be a species of *Uromyces*.

3. *Uredo Yoshinagai* Diet., in Engl., Bot. Jahrb., 37, 1906, (109).

Hab. On *Arundinella anomala* Steud.

Distrib. Japan.

REMARKS. DIETEL (9) has suggested the affinity of the present species to the uredospore of *Puccinia peridermiospora* (Ell. et Tracy) Arth. on *Spartina cynosuroides* of North America.

B. Paraphyses present in the sori.

4. *Uredo jozankensis* S. Itō. n. sp.—(Pl. XII. Fig. 10).

Uredosori, hypophyllous; very minute, oblong or ellipsoidal, on the dark brownish spots, scattered, not confluent, rarely arranged in lines, long covered by epidermis, when ruptured pulverulent, orange-colored. Uredospores globose, subglobose or piriform, echinulate, $15-20 \times 14-17\mu$; germ-pores inconspicuous; episporium yellow; paraphyses clavate, apex slightly thickened ($2-3\mu$), yellow-ochre colored, $28-40 \times 9-14\mu$.

Hab. On *Melica nutans* L.

Hokkaidō.—Prov. Ishikari: Jōzankei (II. Aug. 22, 1898. K. MIYABE; II. Aug. 24, 1898. T. NISHIDA); Yamahana (II. Sept. 15, 1907. S. ITŌ); Maruyama (II. Sept. 22, 1907. S. ITŌ).

Distrib. Japan.

REMARKS. Compared with *Puccinia Melicæ* of Europe, our species resembles it very closely in the remarkably small size of their uredospores. But they differ from each other in the fact that in our species there are yellow-ochre colored clavate paraphyses, although few in number, while ERIKSSON particularly laid stress on the absence of paraphyses in the sori of *Puccinia Melicæ*.

5. Uredo Bromi-paucifloræ S. Itō. n. sp.—(Pl. XII. Fig. 13).

Uredosori, epiphyllous; minute, oblong or sublinear, scattered or gregarious, often confluent, naked, with ruptured epidermis, pulverulent, brownish yellow. Uredospores, globose or broadly ellipsoidal, echinulate, yellow or brownish yellow, $20-32 \times 20-28\mu$; epispore thin; germ-pores 6-8 (rarely 10); paraphyses numerous, clavate, hyaline, apex not thickened, $44-86 \times 14-22\mu$.

Hab. On *Bromus pauciflorus* Hack.

Hokkaidō.—Prov. Oshima: Kamiiso (II. July 12, 1890. K. MIYABE).

REMARKS. Although there are many species of *Puccinia* known to be parasitic on *Bromus*, yet *Puccinia coronata* is the only species that has the paraphyses in the uredosori. While our species has numerous germ-pores, *Puccinia coronata* only 3 or 4. Moreover, the shape of their paraphyses are quite different.

The present species seems to agree *Puccinia gibberosa* on *Festuca* which is closely related in its systematic position to *Bromus*.

6. Uredo Polliniæ-imberbis S. Itō. n. sp.—(Pl. XII. Fig. 11).

Uredosori, hypophyllous; minute, roundish or oblong, on brownish spots, scattered or gregarious, sometimes confluent, naked, pulverulent, inconspicuous, orange-colored. Uredospores, globose, subglobose or piriform, densely echinulate, yellow or yellowish-brown, $20-26 \times 16-24\mu$; epispore thin; germ-pores 5-9, rarely 11, scattered irregularly; paraphyses numerous,

irregularly bent, apex thickened ($6-8\mu$), $30-48 \times 10-14\mu$, light yellow in color.

Hab. On *Pollinia imberbis* Nees. var. *Willdenowiana* Hack.

Formosa.—Daihoku (II, Oct. 11, 1906. T. KAWAKAMI & R. SUZUKI).

Distrib. Japan.

REMARKS. There are three species of *Puccinia* known at present to be parasitic on *Pollinia*. They are *Puccinia Eulaliæ*, *P. Polliniæ* and *P. æstivalis*.

Puccinia Eulaliæ and *P. æstivalis* have already been found in our country and the uredospores and paraphyses differ entirely from those of this species. Now, when comparing the present species to *Puccinia Polliniæ*, I noticed two points of difference between them. (1) Our species has numerous germ-pores while they are three in the case of *Puccinia Polliniæ*. (2) Paraphyses are irregularly bent in our species, while they are capitate in *Puccinia Polliniæ*. I shall call this species provisionally under the present name until its teleutospores will be found.

7. *Uredo inflexa* S. Itō. n. sp.—(Pl. XII. Fig. 12).

Uredosori, hypophyllous; minute, roundish or oblong, on discolored spots, scattered or subgregarious, sometimes confluent, naked, pulverulent, brownish yellow. Uredospores, broadly ellipsoidal, subglobose or piriform, echinulate, $28-40 \times 20-26\mu$; paraphyses numerous, curved, clavate, light yellowish, $40-45 \times 5-9\mu$.

Hab. On *Sasa* sp.

Formosa.—Daihoku (II. R. SUZUKI).

Distrib. Japan.

REMARKS. Among the description of the uredosori of many *Puccinia* on Bambuseæ, that of *Puccinia melanocephala* Syd., of India approaches most closely to the present *Uredo*. But as our species is still lacking its teleutostage, the exact identification can hardly be made. But the uredosori are amphigenous in the Indian species, while they are all hypophyllous in ours. The epispore is a little thinner in our species. The paraphyses are curved in ours. I shall call the fungus under consideration by the present name, until its other stages will be found.

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	<i>Lonicera cærulea</i> L. var. <i>villosa</i> Torr. et Gray.
	„ <i>Chamissoni</i> Bge.
„ <i>Festucæ</i> Plowr.	„ <i>chrysantha</i> Turcz.
	„ <i>Glehni</i> Fr. Schm.
	„ <i>Maximowiczii</i> Rupr.
„ <i>fijiensis</i> n. sp.....	<i>Anthxanthum japonicum</i> Hack.
„ <i>Glyceriæ</i> n. sp.....	<i>Glyceria aquatica</i> Sm.
	„ <i>tonglensis</i> Clk.

<i>Puccinia glumarum</i> (Schm.) Eriks. et Henn.....	{	<i>Hordeum sativum</i> Jess. <i>Triticum vulgare</i> Vill. " <i>monococcum</i> L.
	{	<i>Agrostis alba</i> L. " <i>canina</i> L. " <i>stolonifera</i> L. <i>Avena chinensis</i> Hort. " <i>sativa</i> L. " <i>sterilis</i> L. " <i>strigosa</i> Schreb.
" <i>graminis</i> Pers.	{	<i>Berberis vulgaris</i> L. (L) <i>Hordeum sativum</i> Jess. <i>Triticum monococcum</i> L. " <i>vulgare</i> Vill.
" <i>Hierochloæ</i> n. sp.	{	<i>Hierochloæ borealis</i> Roem <i>Stipa sibirica</i> Lam.
" <i>himalensis</i> (Barcl.) Diet.....	{	<i>Brachypodium japonicum</i> Miq. " <i>silvaticum</i> Beauv.
" <i>ishikariensis</i> n. sp.	{	<i>Molinia japonica</i> Hack.
" <i>Ishikawai</i> n. sp.....	{	<i>Calamagrostis Epigejos</i> Roth, var. <i>densiflora</i> Led.
" <i>kozukensis</i> Diet.....	{	<i>Andropogon micranthus</i> Kth.
	{	<i>Arundinaria Narihira</i> Mak, " <i>Narihira</i> Mak. forma <i>Yashadake</i> Mak. " <i>Simoni</i> Riv. " <i>Simoni</i> Riv. var. <i>Chino</i> Mak. " <i>Simoni</i> Riv. var. <i>variegata</i> Hack. " <i>variabilis</i> Mak. var. <i>Tanakæ</i> Mak. " <i>variabilis</i> Mak. var. <i>viridi-striata</i> Mak. " <i>variabilis</i> Mak. forma <i>foliis glabris</i> Mak. " <i>variabilis</i> Mak. forma <i>foliis pubes-</i> <i>centibus</i> Mak.
" <i>Kusanoi</i> Diet.	{	<i>Sasa nipponica</i> Mak. et Shib.
" <i>Kusanoi</i> Diet. var. <i>Azuma</i> Kusano.....	{	" <i>ramosa</i> Mak. et Shib.
" <i>Lolii</i> Niels.	{	<i>Avena fatua</i> L. " <i>sativa</i> L. " <i>sterilis</i> L.

	<i>Arundinaria japonica</i> S. et Z.
<i>Puccinia longicornis</i> Pat. et Har.....	{ <i>Sasa albo-marginata</i> Mak. et Shib. ,, <i>paniculata</i> Mak. et Shib.
„ <i>Magnusiana</i> Kcern.....	<i>Phragmites communis</i> Trin.
„ <i>microspora</i> Diet.....	<i>Rottballia compressa</i> L. var. <i>japonica</i> Hack.
„ <i>mitriformis</i> n. sp.....	<i>Sasa paniculata</i> Mak. et Shib.
„ <i>Miyoshiana</i> Diet.....	{ <i>Spodiopogon cotulifer</i> Hack. ,, <i>sibiricus</i> Trin.
„ <i>Molinia</i> Tul.....	<i>Molinia japonica</i> Hack.
„ <i>moriokaensis</i> n. sp.....	<i>Phragmites communis</i> Trin.
„ <i>Nakanishikii</i> Diet.....	<i>Andropogon Nardus</i> L. var. <i>Geringii</i> Hack.
„ <i>oahuensis</i> Ell. et Ev.	<i>Panicum sanguinale</i> L.
„ <i>okatamaensis</i> n. sp.....	<i>Phragmites communis</i> Trin.
„ <i>perplexans</i> Plowr.....	{ <i>Ranunculus acer</i> L. (I) ,, <i>acer</i> L. var. <i>Stevoni</i> Rgl. (I)
„ <i>persistens</i> Plowr.....	<i>Thalictrum minus</i> L. (I)
„ <i>perennis</i> n. sp.	{ <i>Calamagrostis arundinacea</i> Roth. var. <i>nipponica</i> Hack.
„ <i>Phlei-pratensis</i> Eriks. et Henn.....	<i>Phleum pratense</i> L.
	{ <i>Phyllostachys bambusoides</i> S. et Z. ,, <i>bambusoides</i> S. et Z. var. <i>aurea</i> Mak. ,, <i>bambusoides</i> S. et Z. var. <i>Marli-</i> <i>acea</i> Mak. ,, <i>bambusoides</i> S. et Z. forma <i>Kashi-</i> <i>rodake</i> Mak.
„ <i>Phyllostachydis</i> Kusano.....	
„ <i>Phragmites</i> (Schm.) Kcern.....	{ <i>Phragmites communis</i> Trin. <i>Rumex domesticus</i> Hartm.
	{ <i>Deschampsia cæspitosa</i> Beauv. <i>Petasites japonicus</i> Miq. (I) <i>Poa acroleuca</i> Steud. ,, <i>annua</i> L. ,, <i>palustris</i> L. ,, <i>palustris</i> L. var. <i>strictula</i> Hack. ,, <i>pratensis</i> L. ,, <i>radula</i> Fr. et Sav. ,, <i>trivialis</i> L. ,, <i>viridis</i> Schreb.
„ <i>Poa</i> Niels.....	
„ <i>purpurea</i> Cke.....	<i>Andropogon Sorghum</i> Brot. var. <i>vulgaris</i> Hack.
„ <i>rangiferina</i> n. sp.....	{ <i>Calamagrostis arundinacea</i> Roth. var. <i>sciuroides</i> Hack.

<i>Puccinia rufipes</i> Diet.....	{	<i>Imperata arundinacea</i> Cyr. var. <i>Königii</i> (Benth.) Hack.
„ <i>Sasa</i> Kusano.....		<i>Sasa borealis</i> Mak. et Shib.
„ <i>sessilis</i> Schneid.....		<i>Phalaris arundinacea</i> L.
„ <i>simpex</i> (Körn.) Eriks. et Henn.....		<i>Hordium sativum</i> Jess.
„ <i>stichosora</i> Diet.....	{	<i>Calamagrostis arundinacea</i> Roth. var. <i>sciuroides</i> Hack.
„ <i>Stipa-sibirica</i> n. sp.....		<i>Stipa sibirica</i> Lam.
„ <i>Symphyti-Bromorum</i> Fr. Müll.....		<i>Bromus pauciflorus</i> Hack.
„ <i>triticea</i> Eriks.....		<i>Triticum vulgare</i> Vill.
„ <i>Zoysia</i> Diet.....		<i>Zoysia pungens</i> Willd. var. <i>japonica</i> Hack.
<i>Rostrupia Elymi</i> (West.) Lagerh.....	{	<i>Elymus arenarius</i> L. „ <i>sibiricus</i> L.
„ <i>Miyabeana</i> n. sp.....	{	<i>Brachypodium japonicum</i> Miq. „ <i>pinnatum</i> Beauv.
	{	<i>Arundinaria Simoni</i> Riv. „ <i>Simoni</i> Riv. var. <i>Chino</i> Mak.
<i>Stereostromum corticioides</i> (Berk. et Br.) P. Magnus.....	{	<i>Phyllostachys bambusoides</i> S. et Z. „ <i>puberula</i> Munro. <i>Sasa albo-marginata</i> Mak. et Shib.
<i>Uredo Bromi-paucifloræ</i> n. sp.....		<i>Bromus pauciflora</i> Hack.
„ <i>inflexa</i> n. sp.....		<i>Sasa</i> sp.
„ <i>jozankensis</i> n. sp.....		<i>Melica mutans</i> L.
„ <i>Kühnii</i> (Krüg.) Wak. et Went.....		<i>Saccharum officinarum</i> L.
„ <i>Polliniæ imberbis</i> n. sp.....	{	<i>Pollinia imberbis</i> Nees. var. <i>Willdenowiana</i> Hack.
„ <i>Rottballiæ</i> Diet.....		<i>Rottballia compressa</i> L. var. <i>japonica</i> Hack.
„ <i>Yoshinagai</i> Diet.....		<i>Arundinella anomala</i> Steud.
<i>Uromyces Alopecuri</i> Seym. var. <i>japonica</i> n. var.	{	<i>Alopecurus fulvus</i> L. „ <i>japonicus</i> Steud.
„ <i>coronatus</i> Miy. et Nish.....		<i>Zizania aquatica</i> L.
„ <i>Muehlenbergiæ</i> n. sp.....		<i>Muehlenbergia japonica</i> Steud.
„ <i>ovalis</i> Diet.....		<i>Leersia oryzoides</i> Sw. var. <i>japonica</i> Hack.
„ <i>Setariæ italicae</i> (Diet.) Yoshino.....	{	<i>Setaria italica</i> Beauv. var. <i>germanica</i> Trin. „ <i>viridis</i> Beauv.

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Explanation of Figures.

All figures are drawn to the same magnification ($\times 390$) using a camera-lucida and Zeiss's objective D and ocular 4.

Plate X.

- Fig. 1. *Uromyces ovalis* Diet. on *Leersia oryzoides* Sw. var. *japonica* Hack.
 Fig. 2. " *coronatus* Miyabe et Nishida. on *Zizania aquatica* L.
 Fig. 3. " *Alopecuri* Seym. var. *japonica* n. var. on *Alopecurus fulvus* L.
 Fig. 4. " *Setariae italicae* (Diet.) Yoshino. on *Setaria italica* Beauv. var. *germanica* Trin.
 Fig. 5. " *Muehlenbergiae* n. sp. on *Muehlenbergia japonica* Steud.
 Fig. 6. *Puccinia Diarrheniae* Miyabe et Iō. n. sp. on *Diarrhena japonica* Fr. et Sav.
 Fig. 7. " *brevicornis* n. sp. on *Calamagrostis villosa* Mut.
 Fig. 8. " *Epigejos* n. sp. on *Calamagrostis Epigejos* Roth. var. *densiflora* Led.
 Fig. 9. " *pertenuis* n. sp. on *Calamagrostis nipponica* Fr. et Sav.
 Fig. 10. " *Hierochloae* n. sp. on *Hierochloe borealis* Roem.
 Fig. 11. " *Hierochloae* n. sp. on *Stipa Sibirica* Lam.
 Fig. 12. " *rangiferina* n. sp. on *Calamagrostis arundinacea* Roth. var. *sciuroides* Hack
 Fig. 13. " *coronata* Cda. on *Calamagrostis arundinacea* Roth. var. *sciuroides* Hack.

Plate XI.

- Fig. 1. *Puccinia Elymi-sibiricae* n. sp. on *Elymus sibiricus* L.
 Fig. 2. " *Glyceriae* n. sp. on *Glyceria aquatica* Sm.
 Fig. 3. " *brachysora* Diet. on *Brachypodium japonicum* Miq.
 Fig. 4. " *Bromi-japonicae* n. sp. on *Bromus japonicus* Th.
 Fig. 5. " *Ishikawai* n. sp. on *Calamagrostis Epigejos* Roth. var. *densiflora* Led.
 Fig. 6. " *ishikariensis* n. sp. on *Molinia japonica* Hack.
 Fig. 7. " *fujiensis* n. sp. on *Anthoxanthum japonicum* Hack.
 Fig. 8. " *culmicola* Diet. on *Brachypodium japonicum* Miq.
 Fig. 9. " *culmicola* Diet. on *Agropyrum caninum* Beauv.
 Fig. 10. " *Nakanishikii* Diet. on *Andropogon Nardus* L. var. *Goeringii* Hack.
 Fig. 11. " *Arundinellae anomala* Diet. on *Arundinella anomala* Steud.
 Fig. 12. " *erythropus* Diet. on *Miscanthus sinensis* Anders.

Plate XII.

- Fig. 1. *Puccinia moriokaensis* n. sp. on *Phragmites communis* Trin.
 Fig. 2. " *okatamaensis* n. sp. on *Phragmites communis* Trin.
 Fig. 3. " *aestivalis* Diet. on *Pollinia nuda* Trin.
 Fig. 4. " *microspora* Diet. on *Rottboellia compressa* L. var. *japonica* Hack.

- Fig. 5. *Puccinia Stipae sibiricae* n. sp. on *Stipa sibirica* Lam.
Fig. 6. „ *mitriiformis* n. sp. on *Sasa paniculata* Mak. et Shib.
Fig. 7. *Diorchidium levigatum* Syd. et Butl. on *Oplismenus compositus* Beauv.
Fig. 8. *Rostrupia Miyabeana* n. sp. on *Brachypodium japonicum* Miq.
Fig. 9. *Uredo Rottboelliae* Diet. on *Rottboellia compressa* L. var. *japonica* Hack.
Fig. 10. „ *jozankensis* n. sp. on *Melica nutans* L.
Fig. 11. „ *Pollinae imberbis* n. sp. on *Pollinia imberbis* Nees. var. *Willdenowiana* Hack.
Fig. 12. „ *inflexa* n. sp. on *Sasa* sp.
Fig. 13. „ *Bromi pauciflorae* n. sp. on *Bromus pauciflorus* Hack.
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