

## Uredinales of the Islands of Rishiri and Rebun, Hokkaido, Japan

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### Abstract

One hundred and twenty-four rust taxa are found to occur in the Islands of Rishiri and Rebun: 91 in the Rishiri and 88 in the Rebun. Fifty-five taxa are common to both Islands. This difference in rust fungus composition between the Rishiri and the Rebun is not due to different distribution of actual and potential host plants in the Islands. The difference is thought to be a simple reflection of the incompleteness of field survey and collections. Alternatively, it is thought that uneven distribution of rust fungi in the region covering the Islands until Holocene some ten thousand years ago has resulted in currently observed difference in the rust floras between the Islands. In any case, mycogeographically, the Rebun and the Rishiri are included in the same region. Majority of the rust taxa found in the Islands are distributed not only in Hokkaido but also in Honshu, Japan. The rust taxa of alpine or arctic distribution constitute a significant percentage of the total rust flora. Of 124 taxa, 13 species in 7 genera are found in Hokkaido, but not elsewhere in Japan. Four arctic rusts are known only in the Islands. Mycofloristic comparisons show an exceedingly high similarity of the rust flora between the Islands and the Russian Far East and China and a dissimilarity to North America. The similarity of the rust flora between the Islands and the Eurasian Continent is a reflection of the paleogeographic events through which vascular-plant and rust floras were founded. A long-distance wind dispersal is also suggested to interpret the rust floral similarity.

### Introduction

The earliest collection of a rust fungus in the Rishiri Island seems to be *Pucciniastrum agrimoniae* (Tranz.) Diet. on *Agrimonia pilosa* Ledeb. which was collected on 25 August 1894 by Kingo Miyabe, a Professor of Sapporo Agriculture College (now Hokkaido University). But Kawakami (1900) was the first to publish the rust collections from the Rishiri Island, who surveyed and collected rust fungi, among other vascular plants and parasitic fungi, in his course of the floristic study of the Island in 1899. He collected more than 50 parasitic fungi, and reported one chitrid, two smuts, and six rusts (Kawakami, 1900). The rusts included were *Uromyces acutatus* Fuck. (= *U. japonicus* Berk. & Curt.) on *Allium victorialis* L. subsp. *platyphyllum* Hult., *U. soldaginis* (Sommf.) Niessl. (= *U. sommerfeltii* Hyl., Joerst. & Nannf.) on

*Solidago virgaurea* L., *Puccinia schelliana* Thüm. (= *P. vesiculosa* Schlecht.) on *Anemone narcissiflora* L., *P. mamillata* Schröt. (= *P. calumnata* H. Syd. & P. Syd.) on *Polygonum wyrichii* Fr. Schm. var. *alpinum* Maxim., *Puccinia* sp. (probably *P. bistortae* DC.) on *Polygonum bistorta* L., and *Aecidium* sp. (probably an aecial anamorph of *P. stipae-sibiricae* S. Ito) on *Sedum rosea* (L.) Scop. The earliest collection of a rust fungus in the Rebun Island is traced back to the specimen of *Puccinia elymi* Westend. on *Elymus mollis* Trin. which was collected on 23 August 1894 by Kingo Miyabe. No collection from the Rebun Island was published until the account made by Togashi (1924).

Togashi (1924) was the first to study plant parasitic fungi systematically in both Rishiri and Rebun Islands. He reported 139 species of various fungal families in four classes then accepted. As to the rust fungi, his report included 76 species in 17 genera accepted at that time. His list was supplemented by Terui (1930), who reported 23 rust species in 6 genera among few others. A few mycologists have since visited and collected in the Islands, and the fungal collection records are scattered in the literature.

This study intends to elucidate a rust fungus composition in the mycoflora of the Islands of Rishiri and Rebun and to study their mycogeographic status. The list of the rust taxa herein reported is based on the study of the specimens recently collected by us and also on the compilation of the collection records appeared in the literature. Field survey and collections were made by Y. Ono (Y. O.) in 1984, 1985 and 1989, and by Y. Ono, T. Isono and K. Higuchi in 1991. All the specimens cited are deposited in the Herbarium of Systematic Mycology, Faculty of Education, Ibaraki University (IBA). In the list, the rust taxa are arranged in an alphabetical order irrespective of their possible taxonomic and phylogenetic relations. Capital letters, S, A, U, and T, that follow the IBA accession number respectively denote spermatogonial, aecial, uredinial, and telial stage borne on the specimens.

#### Enumeration of rust taxa

*Aecidium mori* Barclay, J. Asiatic Soc. Bengal 60: 226. 1891.

Published record: on *Morus bombycis* Koidzumi: Rishiri Island, Oniwaki, 7 Aug. 1922. K. Togashi (Togashi, 1924).

*Arthuriomyces peckianus* (Howe) Cummins & Y. Hiratsuka, Illust. Gen. Rust Fung. (rev. ed.) p. 78. 1983.

On *Rubus pseudo-japonicus* Koidzumi: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1000m, 20 Sept. 1984. Y. O. 1496 (IBA-3041: T); Mt. Rishirisan, along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2440 (IBA-5796: T).

In Japan, a few collections of this circumpolar species have been made only in Hokkaido.

*Chrysomyxa expansa* Dietel, Bot. Jahrb. 28: 287. 1900.

Published record: on *Rhododendron aureum* Georgi (as *R. chrysanthum* Pall.):

Rishiri Island, Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924)

*Chrysomyxa ledi* de Bary, Bot. Zeit. 37: 809. 1879.

On *Ledum palustre* L. subsp. *diversipilosum* (Nakai) Hara: Rishiri Island, Minamihama, 19 Sept. 1984. Y. O. 1470 (IBA-3013: U); 27 June 1985. Y. O. 1575 (IBA-3147: U); on *Picea glehnii* (Fr. Schmidt) Masters; Rishiri Island, Minamihama, 4 Aug. 1991. Y. O. et al. 2447 (IBA-5803: S, A); 4 Aug. 1991. Y. O. et al. 2449 (IBA-5805: S, A); Rishiri Island, on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2457 (IBA-5813: S, A).

Published records: on *Picea glehnii* (Fr. Schmidt) Masters: Rishiri Island, Otadomari, 7 Aug. 1922. K. Togashi (Togashi, 1924: as *C. rhododendri* de Bary); on *Ledum palustre* L. subsp. *diversipilosum* (Nakai) Hara (as *L. palustre* var. *yezoense* Nakai): Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930).

*Coleosporium asterum* (Dietel) H. Sydow & P. Sydow, Ann. Mycol. 12: 109. 1914.

On *Aster glehnii* Fr. Schmidt: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2430 (IBA-5786: U, T).

*Coleosporium cimicifugatum* Thümen ex Komarov in Jaczewski, Komarov & Tranzschel, Fung. Ross. exsicc. no. 175. 1899.

On *Cimicifuga simplex* Wormsk var. *ramosa* Maxim: Rebun Island, along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1926 (IBA-3903: T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1000m, 20 Sept. 1984. Y. O. 1497 (IBA-3042: U, T); alt. ca. 1200m, 2 Sept. 1989. Y. O. 1842 (IBA-3819: U, T); alt. ca. 400m, 2 Aug. 1991. Y. O. et al. 2390 (IBA-5746: U, T); alt. ca. 900m, 2 Aug. 1991. Y. O. et al. 2397 (IBA-5753: U, T); alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2415 (IBA-5771: U, T); along Kutsugata trail, alt. ca. 300m, 1 Sept. 1989. Y. O. 1807 (IBA-3784: U, T); alt. ca. 800m, 2 Sept. 1989. Y. O. 1824 (IBA-3801: U, T); alt. ca. 1600m, 2 Sept. 1989. Y. O. 1834 (IBA-3811: U, T); Rebun Island, on a trail from Nishiuedomari to Horonai River, 18 Sept. 1984. Y. O. 1454 (IBA-2997: U, T).

Published records: on *Cimicifuga simplex* Wormsk. var. *ramosa* Maxim. (as *Cimicifuga foetida* L. var. *intermedia* Regel.): Rebun Island, 24 Aug. 1907. M. Miura (Togashi, 1924); Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924; Kaneko, 1981); Rishiri Island, 2 Sept. 1899. T. Kawakami (Togashi, 1924).

*Pinus strobus* L. is experimentally proven to serve as a spermatogonial-aecial host of this fungus. *Pinus pumila* Regel, another *Haploxyton-Pinus* native to the Islands, may serve as the host as suspected by Joerstad (1934), but this needs to be experimentally proven.

*Coleosporium eupatqrii* Hiratsuka, f., Trans. Sapporo Nat. Hist. Soc. 9: 221. 1927.

On *Eupatqrium chinense* L. subsp. *sacchalinense* (Fr. Schm.) Kitamura: Rebun Island, on a trail between Rebundaki and Rebun-rindo, 17 Sept. 1984. Y. O. 1439 (IBA-2982: U, T).

*Coleosporium lycopi* H. Sydow & P. Sydow, Ann. Mycol. 11: 402. 1913.

On *Adenophora triphylla* (Thunb.) A. DC. var. *aperticampaulata* Kitamura: Rebun

Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2521 (IBA-5876: T); on a trail from Nishiuedomari to Horonai River, 18 Sept. 1984. Y. O. 1455 (IBA-2998: U, T); along a trail between Motoji Lighthouse and Momoiva, 8 Aug. 1991. Y. O. et al. 2577 (IBA-5932: T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1422 (IBA-2965: U, T); on a trail between Rebundaki and Rebut-rindo, 17 Sept. 1984. Y. O. 1438 (IBA-2981: U, T).

Published records: *Adenophora triphylla* (Thunb.) A. DC. var. *aperticamparulata* Kitamura (as *A. thunbergiana* Kudo): Rishiri Island, Mt. Rishirisan, Aug. 1899. T. Kawakami (Togashi, 1924: as *Coleosporium camparulae* (Pers.) Lév.); Oshidomari, 7 Aug. 1922. K. Togashi (Togashi, 1924: as *C. camparulae*; Kaneko, 1981).

*Coleosporium neocacaliae* Saho, Trans. Mycol. Soc. Japan 7: 59. 1966.

On *Cacalia hastata* L. subsp. *orientalis* Kitamura: Rebut Island, along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1923 (IBA-3900: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1200m, 2 Sept. 1989. Y. O. 1843 (IBA-3820: U, T); alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2414 (IBA-5770: U, T); on *Senecio cannabifolius* Less.: Rebut Island, along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1463 (IBA-3006: U, T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1421 (IBA-2964: U, T); Rishiri Island, Otadomari-numa, 19 Sept. 1984. Y. O. 1476 (IBA-3019: U, T); Mt. Rishirisan, along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1796 (IBA-3773: U, T); on *Senecio pseudo-arnica* Less.: Rebut Island, Jizoiwa, on a west trail to Rebundaki, 17 Sept. 1984. Y. O. 1433 (IBA-2976: U, T).

Published records: on *Cacalia hastata* subsp. *farfaraefolia* (Maxim.) Kitamura (as *C. farfaraefolia* Sieb. & Zucc. var. *farfaraefolia* Maxim.): Rishiri Island, Aug. 1907. M. Miura (Togashi, 1924: as *C. cacaliae* Otth); on *Cacalia hastata* L. subsp. *orientalis* Kitamura (as *C. hastata* L. var. *glabra* Ledeb.): Rebut Island, Aug. 1907. M. Miura (Togashi, 1924: as *C. cacaliae*); on *Senecio cannabifolius* Less. (as *Senecio palmatus* Pall.): Rebut Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *Coleosporium senecionis* Fries; Kaneko, 1981); Kafuka, N. Miratsuka (Kaneko, 1981).

Joerstad (1934) suspected that the fungus (*Coleosporium senecionis* in his sense) on *Cacalia auriculata*, *C. hastata*, and *Senecio palmatus* is obligately heteroecious in Kamtschatka and its spermogonial-aecial stage may occur on *Pinus pumila* Regel there. *Pinus koraiensis* Sieb. & Zucc. and *P. strobus* L. are experimentally known to serve as a spermogonial-aecial host of this fungus (Kaneko, 1981). Because *P. pumila* is a *Haploxyton-Pinus*, it may serve as a host of this fungus. But this needs to be proven through an artificial inoculation experiment.

*Coleosporium parvisporum* S. Kaneko, Rep. Tottori Mycol. Inst. 19: 112. 1981.

On *Cacalia auriculata* DC. var. *kamtschatica* Matsumura: Rebut Island, along a trail between Rebut-rindo and Uennai, 9 Aug. 1991. Y. O. 2582 (IBA-5937: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1400m, 2 Sept. 1989. Y. O. 1836 (IBA-3813: U, T); alt. ca. 1000m, 2 Aug. 1991. Y. O. et al. 2399 (IBA-5755: U, T); along Kutsugata trail, alt. ca. 300m, 1 Sept. 1989. Y. O. 1803 (IBA-3780: T); alt. ca. 300m, 1 Sept. 1989. Y. O. 1810 (IBA-3787: T); Mt. Rishirisan, along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2438 (IBA-5794: U, T).



Published records: on *Cacalia auriculata* DC. var. *kantschatica* Maxim.: Rebun Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *C. cacaliae* Otth; Kaneko, 1981); Rishiri Island, Mt. Rishirisan, M. Okamoto (Knaeko, 1981).

Spermogonial-aecial stage of this fungus is not known (Kaneko, 1981). As stated above, Joerstad (1934) suspected that *Coleosporium* on *Cacalia auriculata* may form its spermogonial-aecial stage on *Pinus pumila*.

*Coleosporium phellodendri* Komarov in Jaczewski, Komarov & Tranzschel, Fung. Ross. exsicc. no. 274. 1899.

On *Phellodendron amurense* Ruprecht: Rebun Island, along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1462 (IBA-3005: U, T); Mt. Rebundake, along Nairo trail, alt. ca. 400m, 4 Sept. 1989. Y. O. 1866 (IBA-3843: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 200m, 20 Sept. 1984. Y. O. 1479b (IBA-3023: U, T); alt. ca. 400m, 20 Sept. 1984. Y. O. 1487 (IBA-3032: U, T); alt. ca. 600m, 20 Sept. 1984. Y. O. 1490 (IBA-3035: U, T); along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1797 (IBA-3774: U, T); along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2444 (IBA-5800: U, T); on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2452 (IBA-5808: U, T).

Published records: on *Phellodendron amurense* Rupr. (as var. *sachalinense* Fr. Schmidt): Rishiri Island, Oniwaki, 5 Aug. 1922. K. Togashi (Togashi, 1924).

*Coleosporium saussureae* Thümen, Bull. Soc. Imp. Nat. Moscou 52: 212. 1877.

On *Ligularia hodgsonii* Hook., f.: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2518 (IBA-5873: U, T); along a trail above Rebundaki, 5 Sept. 1989. Y. O. 1887 (IBA-3864: T); along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2490 (IBA-5845: T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2502 (IBA-5857: U, T); 6 Sept. 1989. Y. O. 1904 (IBA-3881: U, T); along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2586 (IBA-5941: U, T); Kitousu, alt. ca. 50m, 4 Sept. 1989. Y. O. 1875 (IBA-3852: T); Mt. Rebundake, along a trail to Kitousu, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2562 (IBA-5917: U, T); on *Saussurea riederi* Herder var. *insularis* Tatewaki & Kitamura: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2519 (IBA-5874: U, T); along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2492 (IBA-5847: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1905 (IBA-3882: U, T); 5 Aug. 1991. Y. O. et al. 2503 (IBA-5858: U, T); 5 Aug. 1991. Y. O. et al. 2507 (IBA-5862: T); along a trail above Rebundaki, 5 Sept. 1989. Y. O. 1888 (IBA-3865: T); along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2588 (IBA-5943: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1500m, 2 Sept. 1989. Y. O. 1835 (IBA-3812: T); alt. ca. 1300m, 2 Sept. 1989. Y. O. 1841 (IBA-3818: T); alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2413 (IBA-5769: U, T).

Published records: on *Ligularia hodgsonii* Hook., f. (as *Ligularia calthaeifolia* Maxim.): Rebun Island, Momoiwa, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *Coleosporium ligulariae* Thümen); Kafuka, N. Hiratsuka (Kaneko, 1980); Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924: as *C. ligulariae*).

This is only *Coleosporium* species that can complete its heteroecious life cycle

and perpetuate in the Islands, host-alternating between *Pinus pumila* and *Ligularia* and *Saussurea* plants. But its spermogonial-aecial stage, that occurs on needles of *Pinus pumila*, has not yet been collected in the Islands.

*Cronartium kamschaticum* Joerstad, Skft. Norske Vid. Akad. Oslo, I. Math. Nat. Kl. 9: 27. 1933.

On *Pedicularis chamissonia* Steven var. *japonica* (Miq.) Maxim.: Rebun Island, along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2579 (IBA-5934: U); along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2525 (IBA-5880: U); along a trail between Motoji Lighthouse and Momiwa, 8 Aug. 1991. Y. O. et al. 2568 (IBA-5923: U); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2511 (IBA-5866: U, T); 5 Aug. 1991. Y. O. et al. 2515 (IBA-5870: U, T); 6 Sept. 1989. Y. O. 1906 (IBA-3883: U); 6 Sept. 1989. Y. O. 1910 (IBA-3887: U); along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1464 (IBA-3007: T); along Rebun-rindo to Kafuka, 6 Aug. 1991. Y. O. et al. 2534 (IBA-5889: U); Nishiuedomari, 18 Sept. 1984. Y. O. 1452 (IBA-2995: T).

The biological relationship between this fungus whose uredinial-telial stage occurs on *Pedicularis chamissonia* Steven var. *japonica* (Miq.) Maxim. and *Cronartium ribicola* J. C. Fischer whose uredinial-telial stage occurs on *Ribes* spp. is not fully understood. *Pedicularis* plants are experimentally proven to serve as a uredinial-telial host of *C. ribicola* in Honshu, Japan and Korea. But aeciospores formed on *Pinus pumila* by a inoculation of basidiospores from *Ribes* plants did not infect *Pedicularis* plants in the Rebun Island (see discussion below). This suggests that the fungi on *Pedicularis* and on *Ribes* found in the Islands are biologically, as well as morphologically, different and deserve distinct taxonomic status.

No successful inoculation of the basidiospores from the *Pedicularis* plants has been made onto shoots of *Pinus pumila* or other suspected potential hosts. Joerstad (1934) suggested that *Peridermium kurilense* Dietel that occurs on *P. pumila* and is distributed in the Kurile Islands may be an aecial anamorph of this species. Otherwise, *Pinus koraiensis* is a more possible candidate for a spermogonial-aecial host for this fungus. This fungus is very common and the *Pedicularis* plants are often heavily infected in the Rebun Island, but so far not found in the Rishiri Island. Because the possibility for this fungus to overwinter on the dead *Pedicularis* plants is negligible, if not at all possible, this fungus must host-alternate onto a potential host, *P. pumila*, in the Rebun Island. Otherwise, we have to look for a possibility of the annual long dispersal of either aeciospores formed on an appropriate alternate host(s) or urediniospores formed on *Pedicularis* plant(s) either from the mainland of Hokkaido or from the maritime region of the Eurasian Continent as in the case suggested for *C. ribicola*.

*Cronartium ribicola* J. C. Fischer ex Rabenhorst, Fungi Europaei no. 1595. 1872; Hedwigia 11: 182. 1872.

On *Ribes formosana* Hayata var. *sinanense* (F. Maekawa) Kitamura: Rishiri Island, on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2458 (IBA-5814: T).

Published records: on *Ribes sachalinensis* (Fr. Schmidt) Nakai: Rebun Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924); on *Ribes latifolium* Jancz.:

Funadomari, Sept. 1959. T. Igarashi (Igarashi, 1978).

Igarashi (1978) reported that when healthy nursery stocks of *Pinus strobus* L. and *P. koraiensis* Sieb. & Zucc. were transplanted in the place near Funadomari, the Rebun Island, where uredinial-telial state of *Cronartium ribicola* naturally occurred on *R. latifolium* in 1966, aecial blisters appeared on ten out of 40 stocks of *P. strobus* in 1973, but not on *P. koraiensis*. The aeciospores were inoculated onto healthy plants of *Ribes* spp. and *Pedicularis* spp., and successfully infected and sporulated only on *Ribes* spp. No *Pedicularis* plants nearby *Cronartium*-infected *Ribes* plants were found to be infected. Similarly, it is known that only *Pinus strobus* is infected by *C. ribicola*, and that all blister rust of *P. pumila* are caused by endocyclic *Endocronartium* species, not by host-alternating *Cronartium* in Hokkaido (Imazu, 1991). This is contradictory to the general view founded by the repeated inoculation experiments that *C. ribicola* alternates between *Pinus pumila* and both *Ribes* and *Pedicularis* spp. in Honshu, Japan and Korea. These suggests that populations of *C. ribicola* in Hokkaido in a broad sense are physiologically restricted to *Ribes* (as uredinial-telial host) and *Pinus strobus* (as spermogonial-aecial host), that all populations of a uredinial-telial fungus on *Pedicularis* plants in the region is biologically and taxonomically different from *C. ribicola* as we believe (see the above discussion).

There have been no extensive plantation of pines, e.g. *Pinus strobus*, that are potential hosts of this fungus. All the stem blister rusts of native *Pinus pumila* in both Rishiri and Rebun Islands are found to be caused by the following *Endocronartium* species, requiring neither *Ribes* nor *Pedicularis* for completion of life cycle. However, *P. pumila* is a potential host of *C. ribicola*. It must have served as an spermogonial-aecial host for this fungus to persist in the Islands. More extensive field survey and collections are required to confirm this perspective. Contrarily, the aeciospores formed on some actual host or urediniospores on *Ribes* plants might have been carried onto *Ribes* plants annually by a long wind-dispersal either from the mainland of Hokkaido or the maritime region of the Eurasian Continent. This may explain relatively rare occurrence of the uredinial-telial state of this fungus on *Ribes* plants in the Islands. As a matter of fact, the above specimen (IBA-5814) consists of only two infected leaves with a few telial columns.

*Endocronartium sahoanum* Imazu & Kakishima in Imazu, Kakishima & Kaneko, Trans. Mycol. Soc. Japan 30: 308. 1989. var. *hokkaidoense* Imazu & Kakishima, to be published in Trans. Mycol. Soc. Japan Vol. 33. 1992.

Collection records: on *Pinus pumila* Regel: Rishiri Island, Mt. Rishirisan, 14 June 1989, M. Kakishima (TSH-R614 & 615); 27 June 1990, M. Imazu (TSH-R616) (Imazu and Kakishima, 1992).

*Endocronartium sahoanum* var. *sahoanum* occurs in Tohoku district of Honshu, and var. *hokkaidoense* in Hokkaido. These two varieties and the following species, *E. yamabense*, are recognized as distinct by the spore surface structure and nuclear behavior in germlings (or metabasidia) (Imazu and Kakishima, 1992; Imazu et al., 1991). This variety is so far not known in the Rebun Island.

*Endocronartium yamabense* (Saho & Takahashi) Paclt, Mitt. Disch. Dendrol. Ges. 77:

238. 1987.

Published records: on *Pinus pumila* Regel: Rebus Island, Mt. Rebusake, 12 June 1989. M. Kakishima (Imazu et al., 1991).

This endocyclic species is distributed widely but only in Hokkaido. Three rust blisters collections have been made on shoots of *Pinus pumila* in the Rebus Islands, and, so far studied, this is the only fungus that causes *P. pumila* blister rust in the Rebus (Imazu, 1991). No reason for the differential distribution of *E. sahoanum* var. *hokkaidoense* and *E. yamabense* is apparent.

*Gymnostromangium juniperi* Link, Mag. Ges. Naturf. Freunde Berlin 3: 7. 1809.

On *Sorbus sambucifolia* (Cham. & Schlecht.) Roemer: Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 1100m, 2 Sept. 1989. Y. O. 1828 (IBA-3805: S, A); Rebus Island, along a trail above Rebusaki, 6 Aug. 1991. Y. O. et al. 2527 (IBA-5882: S, A); Mt. Rebusake, along a trail from Nairo, alt. ca. 400m, 7 Aug. 1991. Y. O. et al. 2555 (IBA-5910: S, A); alt. ca. 450m, 4 Sept. 1989. Y. O. 1872 (IBA-3849: S, A).

*Melampsora arctica* Rostrup, Medd. Grönland 3: 535. 1888.

Published record: on *Salix aquilonica* Kimura (as *Salix arctica* Pall.): Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930: as *Aecidium periclymeni* Schum.).

This seems to be only record of this fungus in Japan. But the specimen needs to be reexamine to confirm its identity.

*Melampsora epiphylla* Dietel, Bot. Jahrb. 32: 50. 1902.

On *Salix pet-susu* Kimura: Rebus Island, along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1460 (IBA-3003: U, T); along Horonai River to Hamanaka, 6 Sept. 1989. Y. O. 1920 (IBA-3897: U); Mt. Rebusake, along Nairo trail, alt. ca. 450m, 4 Sept. 1989. Y. O. 1871 (IBA-3848: U); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 200m, 20 Sept. 1984. Y. O. 1479a (IBA-3022: U, T); along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1795 (IBA-3772: U).

Published record: on *Salix sachalinensis* Fr. Schmidt: Rishiri Island, Oniwaki, 4 Aug. 1922, K. Togashi (Togashi, 1924: as *Melampsora larici-opaca* Miyabe & Matsumoto; Hiratsuka and Kaneko, 1982).

*Melampsora epitea* (Kunze & Schm.) Thümen, Mitth. Forstl. Versuchsw. Oesterr. 2: 38. 1879.

On *Salix hultenii* Floderus: Rebus Island, Mt. Rebusake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2542 (IBA-5897: U); Rishiri Island, Kanesaki, 4 Aug. 1991. Y. O. et al. 2465 (IBA-5821: U); Mt. Rishirisan, along Oshidomari trail, alt. ca. 200m, 20 Sept. 1984. Y. O. 1481 (IBA-3025: U, T); along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1801 (IBA-3778: U); alt. ca. 400m, 1 Sept. 1989. Y. O. 1814 (IBA-3791: U); Otadomari-numa, 19 Sept. 1984. Y. O. 1474 (IBA-3017: U, T); on *Salix reinii* Fr. & Sav. ex Seemen: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 200m, 3 Aug. 1991. Y. O. et al. 2424 (IBA-5780: U); alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2431 (IBA-5787: U); Kanesaki, 4 Aug. 1991. Y. O. et al. 2463 (IBA-5819: U).



*Melampsora hypericum* Winter in Rabenhorst, Krypt.-Fl. Bd. 2, 1: 241. 1884.

On *Hypericum erectum* Thunb.: Rebun Island, along Rebun-rindo to Kafuka, 17 Sept. 1984. Y. O. 1442 (IBA-2985: U, T); along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2528 (IBA-5883: U); along a trail between Motoji Lighthouse and Momoïwa, 8 Aug. 1991. Y. O. et al. 2570 (IBA-5925: U); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2499 (IBA-5854: U); Gorotamisaki, 18 Sept. 1984. Y. O. 1450 (IBA-2993: U, T); 5 Aug. 1991. Y. O. et al. 2482 (IBA-5837: U).

Published records: on *Hypericum erectum* Thunb.: Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, Mt. Rishirisan, 21 July T. Kawakami K. Togashi (Togashi, 1924); 5 Aug. 1922. K. Togashi (Togashi, 1924); on *Hypericum attenuatum* Choisy var. *fruticulosa* Fr. Schmidt (as *H. yezoense* Maxim.): Rebun Islands, Momoïwa, 9 Aug. 1922 K. Togashi (Togashi, 1924).

*Melampsora kusanoi* Dietel, Bot. Jahrb. 37: 104. 1905.

On *Hypericum kamtschaticum* Ledeb. var. *kamtschaticum* Rebun Island, along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1909 (IBA-3886: U); Mt. Rebundake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2539 (IBA-5894: U); alt. ca. 300m, 4 Sept. 1989. Y. O. 1862 (IBA-3839: U, T); alt. ca. 100m, 4 Sept. 1989. Y. O. 1853 (IBA-3830: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1100m, 2 Sept. 1989. Y. O. 1847 (IBA-3824: U, T); alt. ca. 1000m, 20 Sept. 1984. Y. O. 1495 (IBA-3040: U, T); alt. ca. 1200m, 2 Aug. 1991. Y. O. et al. 2411 (IBA-5767: U, T); on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2456 (IBA-5812: U).

Published record: on *Triadenum japonicum* (Blume) Makino (as *Hypericum crassifolium* (Blume) Nakai): Rishiri Island, Otadomari, 7 Aug. 1922, K. Togashi (Togashi, 1924).

*Melampsora larici-populina* Klebahn, Zeitschr. Pfl.-Krankh. 12: 32. 1902.

Published record: on *Populus nigra* L. var. *italica* DuRoi.: Rishiri Island, Sempoji, 8 Oct. 1923. K. Togashi (Togashi, 1924).

*Melampsorella caryophyllacearum* Schröter, Hedwigia 13: 85. 1874.

On *Abies sachalinensis* Fr. Schm.: Rebun Island, along a trail from Rebundaki to Rebun-rindo, 24 June 1985. Y. O. 1556 (IBA-3127: S, A).

Published records: on *Stellaria fenzlii* Regel (as *S. yezoensis* Maxim.): Rebun Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924); on *Cerastium caespitosum* Gilib. var. *ianthes* (Williams) Hara (as *C. triviale* Link var. *glandulosum* Koch): Rishiri Island, Sempoji, 8 Oct. 1923. K. Togashi (Togashi, 1924).

*Melampsorella itoana* (Hiratsuka) Ito & Homma, Trans. Sapporo Nat. Hist. Soc. 15: 116. 1938.

On *Oxalis acetosella* L.: Rebun Island, along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2580 (IBA-5935: T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1400m, 2 Sept. 1989. Y. O. 1837 (IBA-3814: T); alt. ca. 1200m, 2 Aug. 1991. Y. O. et al. 2407 (IBA-5763: T).



*Melampsoridium alni* (Thümen) Dietel in Engler & Prantl, Natürl. Pflanzenfam. I, Abt. p. 551. 1900.

On *Alnus crispa* (Ait.) Pursh subsp. *maximowiczii* (Call.) Hult.: Rebus Island, along upper stream of Rebundaki, 17 Sept. 1984. Y. O. 1436 (IBA-2979: U, T); along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1928 (IBA-3905: U, T); along a trail above Rebundaki, 5 Sept. 1989. Y. O. 1892 (IBA-3869: U, T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1802 (IBA-3779: U, T); alt. ca. 300m, 1 Sept. 1989. Y. O. 1805 (IBA-3782: U, T); alt. ca. 400m, 1 Sept. 1989. Y. O. 1813 (IBA-3790: U, T); alt. ca. 1500m, 2 Sept. 1989. Y. O. 1833 (IBA-3810: U, T); along Oshidomari trail, alt. ca. 200m, 20 Sept. 1984. Y. O. 1480 (IBA-3047: U, T); alt. ca. 1000m, 2 Aug. 1991. Y. O. et al. 2402 (IBA-5758: U); alt. ca. 1200m, 2 Sept. 1989. Y. O. 1844 (IBA-3821: U, T); along Oniwaki trail, alt. ca. 200m, 3 Aug. 1991. Y. O. et al. 2426 (IBA-5782: U, T); Kanesaki, 4 Aug. 1991. Y. O. et al. 2464 (IBA-5820: U).

Published records: on *Alnus maximowiczii* Callier: Rebus Island, Kafuka, 12 Oct. 1923. K. Togashi (Togashi, 1924); Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924).

*Melampsoridium betulinum* (Desmazieres) Klabahn, Zeitschr. Pfl.-Krankh. 9: 17. 1899.

On *Betula ermanii* Cham.: Rebus Island, along Rebus-rindo to Kafuka, 17 Sept. 1984. Y. O. 1443 (IBA-2986: U, T); along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2531 (IBA-5886: U); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2513 (IBA-5868: U); along a trail between Rebus-rindo and Uennai, 9 Aug. 1991. Y. O. 2583 (IBA-5938: U, T); along a trail above Rebundaki, 5 Sept. 1989. Y. O. 1890 (IBA-3867: U, T); along Rebus-rindo to Kafuka, 17 Sept. 1984. Y. O. 1440 (IBA-2983: T); along Horonari River to Hamanaka, 6 Sept. 1989. Y. O. 1919 (IBA-3896: U, T); Mt. Rebundake, along a trail from Nairo, alt. ca. 400m, 7 Aug. 1991. Y. O. et al. 2557 (IBA-5912: U); alt. ca. 200m, 4 Sept. 1989. Y. O. 1855 (IBA-3832: U, T); alt. ca. 450m, 4 Sept. 1989. Y. O. 1870 (IBA-3847: U, T); alt. ca. 450m, 4 Sept. 1989. Y. O. 1874 (IBA-3851: U, T); on a trail from Nishiuedomari to Horonari River, 18 Sept. 1984. Y. O. 1453 (IBA-2996: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 400m, 20 Sept. 1984. Y. O. 1485 (IBA-3030: U, T); alt. ca. 1000m, 2 Aug. 1991. Y. O. et al. 2403 (IBA-5759: U); alt. ca. 1200m, 20 Sept. 1984. Y. O. 1500 (IBA-3045: U, T); along Kutsugata trail, alt. ca. 300m, 1 Sept. 1989. Y. O. 1806 (IBA-3783: U, T); along Oniwaki trail, alt. ca. 100m, 3 Aug. 1991. Y. O. et al. 2422 (IBA-5778: U); alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2437 (IBA-5793: U).

*Melampsoridium hiratsukanum* S. Ito ex Hiratsuka, f., J. Fac. Agr. Hokkaido Imp. Univ. 21: 9. 1927.

On *Alnus hirsuta* Turcz.: Rebus Island, on a trail from Nishiuedomari to Horonari River, 18 Sept. 1984. Y. O. 1457 (IBA-3000: U, T); along Horonari River to Hamanaka, 6 Sept. 1989. Y. O. 1918 (IBA-3895: U, T).

*Milesina miyabei* Kamei, Trans. Sapporo Nat. Hist. Soc. 12: 169. 1932.

On *Abies sachalinensis* (Fr. Schmidt) Masters: Rebus Island, Mt. Rebundake, along a trail from Nairo, alt. ca. 200m, 7 Aug. 1991. Y. O. et al. 2545 (IBA-5900: S, A);

alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2547 (IBA-5902: S, A); Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2443 (IBA-5799: S, A); alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2446 (IBA-5802: S, A).

*Miyagia anaphalidis* Miyabe ex H. Sydow & P. Sydow, Ann. Mycol. 11: 107. 1913.

On *Anaphalis margaritacea* (L.) Benth. & Hook., f.: Rebun Island, at the base of Momoïwa, 5 Sept. 1989. Y. O. 1884 (IBA-3861: U, T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1424 (IBA-2967: U, T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2505 (IBA-5860: U); along Rebun-rindo to Kafuka, 6 Aug. 1991. Y. O. et al. 2532 (IBA-5887: U); Mt. Rebundake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2540 (IBA-5895: U); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 1300m, 2 Sept. 1989. Y. O. 1830 (IBA-3807: U, T); alt. ca. 400m, 1 Sept. 1989. Y. O. 1817 (IBA-3794: U, T); alt. ca. 500m, 1 Sept. 1989. Y. O. 1820 (IBA-3797: U, T); alt. ca. 600m, 2 Sept. 1989. Y. O. 1821 (IBA-3798: U, T); along Oshidomari trail, alt. ca. 400m, 20 Sept. 1984. Y. O. 1488 (IBA-3033: U, T); alt. ca. 700m, 2 Aug. 1991. Y. O. et al. 2393 (IBA-5749: S, A); along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2445 (IBA-5801: U).

Published records: on *Anaphalis margaritacea* (L.) Benth. & Hook., f.: Rebun Island, 24 Aug. 1907. M. Miura (Togashi, 1924); Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924).

*Miyagia pseudosphaeria* (Mont.) Joerstad, Nytt Mag. Bot. 9: 78. 1961.

On *Sonchus brachyotus* DC.: Rebun Island, the base of Momoïwa, 17 Sept. 1984. Y. O. 1426 (IBA-2969: T).

This circumpolar species has been collected in a few localities in Hokkaido, but not elsewhere in Japan.

*Nyssopsora asiatica* Lütjeharms, Blummea, Suppl. I. 29: 153. 1937.

On *Aralia elata* (Miq.) Seemann: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 200m, 3 Aug. 1991. Y. O. et al. 2425 (IBA-5781: T); alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2429 (IBA-5785: T).

Published records: on *Aralia elata* (Miq.) Seemann (as *A. chinensis* L. f. *asiatica* Komarov): Rishiri Island, Mt. Rishirisan, 21 July 1899. T. Kawakami (Togashi, 1924: as *Triphragmium clavellousum* Berkeley; Lohsomboon et al., 1990); 5 Aug. 1922. K. Togashi (Togashi, 1924: as *T. clavellousum*); 15 Aug. 1907. M. Miura no. 119 (Sydow and Sydow, 1913: as *T. clavellousum* f. *asiaticum* Komarov; Lohsomboon et al., 1990).

*Phragmidium fusiforme* Schröter, Abh. Schles. Ges., Naturw. Abth. 1869-1872: 24. 1872.

On *Rosa nipponensis* Crépin: Rebun Island, along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2587 (IBA-5942: U, T); along a trail between Shiretoko and Motoji Lighthouse, 8 Aug. 1991. Y. O. et al. 2564 (IBA-5919: U, T); along Rebun-rindo to Kafuka, 17 Sept. 1984. Y. O. 1446 (IBA-2989: U, T); Mt. Rebundake, along a trail to Kitousu, alt. ca. 200m, 7 Aug. 1991. Y. O. et al. 2561 (IBA-5916: U, T); along Nairo trail, alt. ca. 100m, 4 Sept. 1989. Y. O. 1850 (IBA-3827: U, T); alt. ca. 200m,

4 Sept. 1989. Y. O. 1856 (IBA-3833: T).

Published record: on *Rosa nipponensis* Crépin (as *R. acicularis* Lindl.): Rebun Island, Mt. Rebundake, N. Hiratsuka (Hiratsuka et al., 1980).

This widely distributed circumpolar species is so far known only from several collections in Hokkaido and a few collections in Mt. Fuji (Yamanashi).

*Phragmidium montivagum* Arthur, Torrey 9: 24. 1909.

On *Rosa rugosa* Thunb.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2496 (IBA-5851: U, T); along a trail between Motoji and Rebundaki, 6 Aug. 1991. Y. O. et al. 2516 (IBA-5871: U, T); along a trail between Motoji Lighthouse and Momoïwa, 8 Aug. 1991. Y. O. et al. 2575 (IBA-5930: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1911 (IBA-3888: U, T); at the base of Momoïwa, 17 Sept. 1984. Y. O. 1430 (IBA-2973: U, T); Jizoiwa, on a west trail to Rebundaki, 17 Sept. 1984. Y. O. 1432 (IBA-2975: U, T); Sukoton, 18 Sept. 1984. Y. O. 1447 (IBA-2990: U, T).

Published records: on *Rosa rugosa* Thunb.: Rebun Island, 24 Aug. 1907. M. Miura (Togashi, 1924: as *Phragmidium rosae-rugosae* Kasai); Ekokinai, 11 Aug. 1911. K. Togashi (Togashi, 1924: as *P. rosae-rugosae*; Hiratsuka et al., 1980); Rishiri Island, 8 Sept. 1899. T. Kawakami (Togashi, 1924: as *P. rosae-rugosae*); Kutsugata, 8 Oct. 1922. K. Togashi (Togashi, 1924: as *P. rosae-rugosae*); Oshidomari, K. Togashi (Hiratsuka et al., 1980).

*Phragmidium rubi-idaei* (de Candolle) Karsten, Bidr. Finl. Nat. Folk 31: 52. 1879.

On *Rubus idaeus* L. subsp. *idaeus*: Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 400m, 1 Sept. 1989. Y. O. 1815 (IBA-3792: T); along Oshidomari trail, alt. ca. 300m, 20 Sept. 1984. Y. O. 1484 (IBA-3029: U, T); alt. ca. 600m, 20 Sept. 1984. Y. O. 1498 (IBA-3043: U, T).

Published records: on *Rubus idaeus* L. subsp. *idaeus*: Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924; Hiratsuka et al., 1980); Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924; Hiratsuka et al., 1980).

This fungus is wide spread in Hokkaido, but has not been collected elsewhere in Japan.

*Phragmidium rubi-japonici* Kasai, Trans. Sapporo Nat. Hist. Soc. 3: 40. 1910.

On *Rubus pseudo-japonicus* Koidzumi: Rebun Island, Mt. Rebundake, along Nairo trail, alt. ca. 450m, 4 Sept. 1989. Y. O. 1868 (IBA-3845: T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1400m, 2 Sept. 1989. Y. O. 1839 (IBA-3823: T).

Published record: on *Rubus pseudo-japonicus* Koidzumi: Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930).

*Pileolaria brevipes* Berkeley & Ravenel in Berkeley, Grevillea 3: 58. 1874.

On *Rhus ambigua* Lavallée ex Dippel: Rebun Island, Mt. Rebundake, along a trail from Nairo, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2553 (IBA-5908: T).

Published records: on *Rhus ambigua* Lavallée ex Dippel: Rebun Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, Otadomari, 7 Aug. 1922. K.

Togashi (Togashi, 1924)

*Puccinia absinthi* (Hedwig, f.) de Candolle, Fl. Fr. 5: 56. 1815.

On *Artemisia iwayomogi* Kitamura: Rebun Island, along a trail between Motoji Lighthouse and Momoïwa, 8 Aug. 1991. Y. O. et al. 2576 (IBA-5931: U); at the base of Momoïwa, 5 Sept. 1989. Y. O. 1882 (IBA-3859: U); 18 Sept. 1984. Y. O. 1469 (IBA-3012: U, T); on *Artemisia japonica* Thunb. subsp. *littoricola* Kitamura: Rebun Island, at the base of Momoïwa, 5 Sept. 1989. Y. O. 1878 (IBA-3855: U); 17 Sept. 1984. Y. O. 1428 (IBA-2971: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1913 (IBA-3890: U, T); on *Artemisia montana* (Nakai) Pampan.: Rebun Island, along Rebun-rindo to Kafuka, 17 Sept. 1984. Y. O. 1441 (IBA-2984: U, T); at the base of Momoïwa, 5 Sept. 1989. Y. O. 1885 (IBA-3862: U, T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1418 (IBA-2961: U, T); Mt. Rebundake, along Nairo trail, alt. ca. 300m, 4 Sept. 1989. Y. O. 1858 (IBA-3835: U); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2509 (IBA-5864: U, T); Rishiri Island, Otadomari-numa, 19 Sept. 1984. Y. O. 1475 (IBA-3018: U, T); Mt. Rishirisan, along Kutsugat trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1791 (IBA-3768: U, T); alt. ca. 300m, 1 Sept. 1989. Y. O. 1808 (IBA-3785: U, T); alt. ca. 500m, 1 Sept. 1989. Y. O. 1819 (IBA-3796: U, T); on *Artemisia schmidtiana* Maxim.: Rebun Island, at the base of Momoïwa, 8 Aug. 1991. Y. O. et al. 2578 (IBA-5933: U); on *Artemisia* sp.: Rebun Island, Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2483 (IBA-5838: U).

Published records: on *Artemisia japonica* Thunb.: Rebun Island, Momoïwa, 12 Oct. 1922. K. Togashi (Togashi, 1924); on *Artemisia japonica* Thunb. subsp. *littoricola* Kitamura (as *A. desertorum* Spreng.: Rebun Island, Momoïwa, 12 Oct. 1923. K. Togashi (Togashi, 1924); on *Artemisia laciniata* Willd. var. *latifolia* Maxim.: Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, Kutsugata, 8 Oct. 1923. K. Togashi (Togashi, 1924); on *Artemisia montana* (Nakai) Pampan. (as *A. vulgaris* L. var. *yezoana* Kudo: Rishiri Island, Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924); on *Artemisia schmidtiana* Maxim.: Rebun Island, Momoïwa, 12 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia acetosae* Körnicke, Hedwigia 15: 184. 1876.

On *Rumex acetosella* L.: Rishiri Island, on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2455 (IBA-5811: U).

*Puccinia adenophorae* Dietel, Ann. Mycol. 28: 276. 1930.

Published records: on *Adenophora triphylla* (Thunb.) A. DC. subsp. *aperticampiculata* Kitamura (as *Adenophora verticillata* Fisch. var. *typica* Regel.): Rebun Island, Momoïwa, 18 July 1930. M. Terui (Terui, 1930: as *Puccinia adenophorae-verticillatae* S. Ito & Terui, sp. nov.; Hiratsuka, 1976).

*Puccinia adoxae* de Candolle, Fl. Fr. 2: 220. 1805.

Published record: on *Adoxa moschatellina* L.: Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930).

In Japan, this alpine microcyclic species has been collected only in Hokkaido.

*Puccinia angustata* Peck, Bull. Buffalo Soc. Nat. Sci. 1: 67. 1873.

Published record: on *Scirpus wichurai* Böckl. (as *S. eriophorum* Michx.): Rishiri Island, Oniwaki, 11 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia arenariae* (Schumacher) Winter, Hedwigia 19: 35. 1880.

Published record: on *Moehringia lateriflora* (L.) Fenzl.: Rebus Island, Momoiva, 16 July 1930. M. Terui (Terui, 1930).

*Puccinia argentata* (Schultz) Winter, Hedwigia 19: 38. 1880.

Published records: on *Impatiens noli-tangere* L.: Rishiri Island, 27 July 1899. T. Kawakami (Togashi, 1924); 15 Aug. 1907. Miura (Togashi, 1924); Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924).

*Puccinia baicalensis* Tranzschel, Acta Inst. Bot. Acad. Sci. URSS, Ser. II. Fasc. I. p. 269. 1933.

On *Aegopodium alpestre* Ledeb.: Rebus Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2495 (IBA-5850: T); along a trail between Motoji Lighthouse and Momoiva, 8 Aug. 1991. Y. O. et al. 2572 (IBA-5927: T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2514 (IBA-5869: T); along a trail between Rebus-rindo and Uennai, 9 Aug. 1991. Y. O. 2585 (IBA-5940: T); along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1557 (IBA-3128: S, A); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1300m, 2 Sept. 1989. Y. O. 1840 (IBA-3817: T); alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2417 (IBA-5773: S, A).

*Puccinia bistorta* de Candolle, Fl. Fr. 6: 61. 1815.

On *Polygonum bistorta* L. subsp. *japonicum* (Hara) T. Shimizu: Rebus Island, along a trail between Motoji Lighthouse and Momoiva, 8 Aug. 1991. Y. O. et al. 2567 (IBA-5922: U, T); along a trail above Rebusdaki, 6 Aug. 1991. Y. O. et al. 2520 (IBA-5875: U, T); around Momoiva, alt. ca. 200m, 5 Sept. 1989. Y. O. 1876 (IBA-3853: U, T); at the base of Momoiva, 5 Sept. 1989. Y. O. 1880 (IBA-3857: T).

Published records: on *Polygonum bistorta* L. subsp. *japonica* (Hara) T. Shimizu (as var. *vulgare* Meisn.): Rebus Island, Momoiva, 9 Aug. 1922. K. Togashi (Togashi, 1924; Hiratsuka and Kaneko, 1973).

*Puccinia calcitrapae* de Candolle, Fl. Fr. 2:221. 1805. var. *centaureae* (de Candolle) Cummins, Mycotaxon 5: 402. 1977.

On *Cirsium kamschaticum* Ledeb., Rebus Island, along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1916 (IBA-3893: U, T); Rishiri Island, Oshidoamri, 26 June 1985. Y. O. 1566 (IBA-3137: S, A).

*Puccinia calumnata* H. Sydow & P. Sydow, Ann. Mycol. 11: 102. 1913.

On *Polygonum weyrichii* Fr. Schmidt var. *alpinum* Maxim.: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 600m, 20 Sept. 1984. Y. O. 1492 (IBA-3037: U, T); alt. ca. 1000m, 20 Sept. 1984. Y. O. 1494 (IBA-3039: U, T); alt. ca. 1400m, 20 Sept. 1984. Y. O. 1503 (IBA-3048: U, T); alt. ca. 1600m, 20 Sept. 1984. Y.



O. 1505 (IBA-3050: U, T); along Kutsugata trail, alt. ca. 1200m, 2 Sept. 1989. Y. O. 1829 (IBA-3806: T); on *Polygonum weyrichii* Fr. Schmidt var. *weyrichii*: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 200m, 3 Aug. 1991. Y. O. et al. 2423 (IBA-5779: U, T); alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2428 (IBA-5784: U, T); alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2433 (IBA-5789: U, T); along Oshidomari trail, alt. ca. 700m, 2 Aug. 1991. Y. O. et al. 2392 (IBA-5748: U, T); alt. ca. 1100m, 2 Aug. 1991. Y. O. et al. 2404 (IBA-5760: U, T); along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1794 (IBA-3771: U, T).

Published records: on *Polygonum weyrichii* Fr. Schmidt var. *alpinum* Maxim.: Rishiri Island, Mt. Rishirisan, T. Kawakami (Kawakami, 1900: as *P. mamillata* Schröter); Aug. 1899. T. Kawakami (Togashi, 1924); 15 Aug. 1907. M. Miura (Sydow and Sydow, 1913: the type; P. Togashi, 1924; Hiratsuka and Kaneko, 1973); 9 Aug. 1922. K. Togashi (Togashi, 1924; Hiratsuka and Kaneko, 1973).

Mt. Rishirisan is the type locality of this species (Sydow and Sydow, 1913).

*Puccinia calthicola* Schröter, Cohn Beitr. Biol. Pfl. 3: 61. 1879.

Published records: on *Caltha palustris* L. var. *typica* Regel: Rebun Island, 24 Aug. 1907. M. Miura (Togashi, 1924: as *Puccinia zopfii* Winter); Tomochi, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *P. zopfii*); Rishiri Island, Mt. Rishirisan, 27 July 1899. T. Kawakami (Togashi, 1924: as *P. zopfii*).

*Puccinia caricina* de Candolle, Fl. Fr. 6: 60. 1815.

On *Carex shimizuensis* Franchet: Rishiri Island, Minamihama, 27 June 1985. Y. O. 1573 (IBA-3145: T); on *Urtica platyphylla* Wedd.: Rishiri Island, Minamihama, 27 June 1985. Y. O. 1574 (IBA-3146: S, A).

Published records: on *Carex scita* Maxim.: Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930: as *Puccinia caricina* (Schum.) Reb.); on *Urtica platyphylla* Wedd. (as *Urtica dioica* L. var. *platyphylla* Wedd.): Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930: as *P. caricina*).

*Puccinia caricis-molliculae* H. Sydow & P. Sydow, Ann. Mycol. 11: 105. 1913.

Published record: on *Carex mollicula* Boott.: Rishiri Island, Oniwaki, 11 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia chaerophylli* Purton, Bot. Descr. Brit. 3: 303. 1821.

On *Anthriscus sylvestris* (L.) Hoffm. subsp. *aemula* (Woron.) Kitamura: Rebun Island, along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1466 (IBA-3009: U).

*Puccinia circaeae* Persoon, Syn. Meth. Fung. p. 228. 1801.

Published records: on *Circaea alpina* L.: Rebun Island, Momojiwa, 16 July 1930. M. Terui (Terui, 1930); Rishiri Island, Mt. Rishirisan, 12 Sept. 1927. M. Okamoto (Hiratsuka, 1976).

*Puccinia conglomerata* (Strauss) Röhling, Deutsch. Fl. Ed. 2. 3: 130. 1813.

On *Petasites japonicum* (Sieb. & Zucc.) Maxim. subsp. *giganteus* (Fr. Schm.) Kitamura: Rebun Island, along a trail from Kafukai to Uennai, 25 June 1985. Y. O.

1561 (IBA-3132: T); Rishiri Island, Nonaka, 27 June 1985. Y. O. 1576 (IBA-3148: T); Minamihara, 27 June 1985. Y. O. 1572 (IBA-3143: T).

*Puccinia chrysanthemi* Roze, Bull. Soc. Mycol. Fr. 16: 92. 1900.

Published record: on *Chrysanthemum indicum* L.: Rishiri Island, Oniwaki, 10 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia coronata* Corda, Icon. Fung. 1: 6. 1837. var. *himalensis* Barclay, Trans. Linn. Soc. London 3: 227. 1891.

On *Calamagrostis canadensis* (Michx.) Nutt. var. *langsдорffii* Inman: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2418 (IBA-5774: U).

Published records: on *Calamagrostis canadensis* (Michx.) Nutt. var. *langsдорffii* Inman (as *C. villosa* Mut.): Rishiri Island, Kutsugata, 8 Oct. 1923. K. Togashi (Togashi, 1924: as *Puccinia brevicornis* S. Ito); Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924: as *P. brevicornis*).

*Puccinia dioicae* Magnus, Amtl. Ber. 50 Versamml. Deut. Nat. Ärzte, München, p. 199. 1877.

Published records: on *Carex gmelini* Hook. & Arnott: Rebun Island, Momoïwa, 12 Oct. 1923. K. Togashi (Togashi, 1924: as *Puccinia caricis* (Schum.) Reb.); on *Aster ageratoides* Turcz. subsp. *ovatus* (Fr. & Sav.) Kitamura (as *A. trinervius* Roxb. var. *adustus* Maxim.): Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia caricis-asteris* Arthur).

*Puccinia elymi* Westendorp, Bull. Acad. Roy. Belg. 18: 408. 1851. var. *longispora* Cummins, Rust Fungi of Cereals, Grasses and Bamboos, p. 289. 1971.

On *Elymus mollis* Trinius: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2491 (IBA-5846: U); along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2480 (IBA-5835: U).

Published records: on *Elymus dahuricus* Turcz.: Rebun Island, Tomochi, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *Rostrupia elymi* (West.) Labenh.); Rishiri Island, 20 Aug. 1907. M. Miura (Togashi, 1924: as *R. elymi*); on *Elymus mollis* Trinius: Rebun Island, 23 Aug. 1894. K. Miyabe (Togashi, 1924: as *R. elymi*); Momoïwa, 9 & 10 Aug. 1922. K. Togashi (Togashi, 1924: as *R. elymi*); Rishiri Island, Oshidomari, 21 July 1899. T. Kawakami (Togashi, 1924: as *R. elymi*); Kutsugata, 2 Sept. 1899. T. Kawakami (Togashi, 1924: as *R. elymi*); 20 Aug. 1907. M. Miura (Togashi, 1924: as *R. elymi*).

*Puccinia erythropus* Dietel, Bot. Jahb. 37: 101. 1905.

Published record: on *Miscanthus sinensis* Anderss.: Rishiri Island, Sempoji, 8 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia fergussonii* Berkeley & Broome, Ann. Mag. Nat. Hist. IV. 15: 35. 1875.

On *Viola selkirkii* Pursh: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 900m, 2 Aug. 1991. Y. O. et al. 2398 (IBA-5754: T); alt. ca. 1000m, 2 Aug. 1991. Y. O. et al. 2401 (IBA-5757: T).

This circumpolar species has been known from four collections in Japan: on *Viola selkirkii* Pursh at Mt. Hakkodasan (Aomori), Mt. Komagatake (Akita), Mt. Jizodake (Yamagata), and Iide Mountains (Yamagata) (Hiratsuka, 1976). *Viola hirtipes* Moore is listed in the literature as a host of this species in Hokkaido, but this has not been confirmed.

*Puccinia ferruginosa* P. Sydow & H. Sydow, Monogr. Ured. I. p. 13. 1902

Published records: on *Artemisia japonica* Thunb. subsp. *littoricola* Kitamura (as *A. desertorum* Spreng).: Rebun Island, 24 Aug. 1907. M. Miura (Togashi, 1924; Hiratsuka, 1976, 1980: as *Puccinia cucis-oleracei* Pers. ex Desm.); Rishiri Island, 20 Aug. 1907. M. Miura (Togashi, 1924).

*Puccinia festucae* Plowright, Grevillea 21: 109. 1893.

On *Festuca ovina* L. var. *alpina* (Wimm.) Grenier: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1600m, 20 Sept. 1984. Y. O. 1504 (IBA-3049: T).

Published records: on *Lonicera caerulea* L. var. *villosa* Torr. & Gray: Rishiri Island, Mt. Rishirisan, 3 Aug. 1896. W. Hirose (Togashi, 1924); 1 Aug. 1899. T. Kawakami (Togashi, 1924).

*Puccinia glomerata* Greville, Fl. Edin. p. 433. 1824.

Published records: on *Cacalia auriculata* DC. var. *kamtschatica* Maxim.: Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *P. ligulariae* Miyabe & Miyake, sp. nov.; Hiratsuka, 1976, 1980); on *Ligularia hodgsonii* Hook., f.: Rebun Island, Momoïwa, M. Terui (Hiratsuka, 1976, 1980).

*Puccinia haleniae* Arthur & Holway in Arthur, Bull. Geol. Nat. Hist. Surv. Minn. 3: 30. 1887.

Published records: on *Halenia corniculata* (L.) Cornaz (as *Halenia sibirica* Borkh.): Rebun Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924; Hiratsuka, 1976).

*Puccinia hemerocallidis* Thümen, Bull. Soc. Imp. Nat. Moscou 55: 81. 1880.

On *Hemerocallis dumortierii* Morren var. *esculenta* (Koidz.) Kitamura: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2522 (IBA-5877: U, T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2497 (IBA-5852: U, T); Mt. Rebundake, along Nairo trail, alt. ca. 450m, 4 Sept. 1989. Y. O. 1867 (IBA-3844: U, T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 1000m, 2 Sept. 1989. Y. O. 1826 (IBA-3803: U, T).

Published records: on *Hemerocallis dumortierii* Morren var. *esculenta* (Koidz.) Kitamura (as *Hemerocallis middendorffii* Trautv. & Mey): Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, 20 Aug. 1907. M. Miura (Togashi, 1924); Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia hieracii* (Röhling) Martius, Prodr. Fl. Mosq. Ed. 2, p. 227. 1817. var. *hieracii*

On *Hieracium umbellatum* L.: Rebun Island, along a trail between Motoji

Lighthouse and Momoïwa, 8 Aug. 1991. Y. O. et al. 2569 (IBA-5924: U, T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2512 (IBA-5867: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1907 (IBA-3884: T); along Rebun-rindo, 5 Sept. 1989. Y. O. 1900 (IBA-3877: T); on *Picris hieracioides* L. subsp. *japonica* (Thunb.) Kryulv.: Rebun Island, along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1915 (IBA-3892: U, T); Mt. Rebundake, along Nairo trail, alt. ca. 100m, 4 Sept. 1989. Y. O. 1848 (IBA-3825: U, T); Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2523 (IBA-5878: U, T); 5 Sept. 1989. Y. O. 1897 (IBA-3874: T); along a trail between Motoji Lighthouse and Momoïwa, 8 Aug. 1991. Y. O. et al. 2571 (IBA-5926: U, T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1423 (IBA-2966: U, T); Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2476 (IBA-5832: U, T); Mt. Rebundake, along a trail from Nairo, alt. ca. 200m, 7 Aug. 1991. Y. O. et al. 2544 (IBA-5899: U, T); Mt. Rebundake, along a trail to Kitousu, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2560 (IBA-5915: U, T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 300m, 1 Sept. 1989. Y. O. 1811 (IBA-3788: U); alt. ca. 100m, 1 Sept. 1989. Y. O. 1799 (IBA-3776: U, T); along Oniwaki trail, alt. ca. 100m, 3 Aug. 1991. Y. O. et al. 2421 (IBA-5777: U, T); Kanesaki, 4 Aug. 1991. Y. O. et al. 2460 (IBA-5816: U, T); on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2453 (IBA-5809: U, T); on *Taraxacum* sp.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2488 (IBA-5843: U, T); along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2469 (IBA-5825: U, T); Rishiri Island, Oshidomari, 26 June 1985. Y. O. 1565 (IBA-3136: U); Mt. Rishirisan, along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1793 (IBA-3770: U); Kanesaki, 4 Aug. 1991. Y. O. et al. 2462 (IBA-5818: U, T).

Published records: on *Picris hieracioides* L. subsp. *japonica* (Thunb.) Kryulv. (as *Picris japonica* Thunb.): Rebun Island, Aug. 1907. M. Miura (Togashi, 1924: as *Puccinia picridis* Hazsl.); Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924; as *P. picridis*); on *Taraxacum platycarpum* Dahlst.: Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930: as *Puccinia taraxaci* Plowr.).

*Puccinia infra-aequatorialis* Joerstad, Skft. Norske Vid. Akad. Oslo, I. Math. Nat. Kl. 9: 132. 1933.

On *Cirsium kantschaticum* Ledeb.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2493 (IBA-5848: U, T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2501 (IBA-5856: U, T); Mt. Rebundake, along Nairo trail, alt. ca. 100m, 4 Sept. 1989. Y. O. 1851 (IBA-3828: U, T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 800m, 2 Sept. 1989. Y. O. 1823 (IBA-3800: U, T); alt. ca. 1300m, 2 Sept. 1989. Y. O. 1832 (IBA-3809: T); along Oniwaki trail, alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2436 (IBA-5792: U, T).

*Puccinia lactucae-debilis* Dietel, Ann. Mycol. 6: 225. 1908.

On *Ixeris dentata* (Thunb.) Nakai: Rishiri Island, along a trail between Pon-yama and Himenuma, 27 June 1985. Y. O. 1567 (IBA-3138: U); Mt. Rishirisan, along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2441 (IBA-5797: U, T).

*Puccinia lactucae-repentis* Miyabe & T. Miyake ex H. Sydow & P. Sydow, Ann. Mycol. 96. 1913.

On *Ixeris repens* L.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2485 (IBA-5840: U, T).

*Puccinia ligusticola* T. Miyake, J. Sapporo Agr. Coll. 2: 118. 1906.

On *Ligusticum scoticum* L.: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2517 (IBA-5872: U, T); along a trail between Motoji Lighthouse and Momoiwa, 8 Aug. 1991. Y. O. et al. 2574 (IBA-5929: U, T); along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2506 (IBA-5861: U, T); along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2467 (IBA-5823: U, T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1419 (IBA-2962: U, T) Momoiwa, 24 June 1985. Y. O. 1551 (IBA-3122: U, T); Sukoton, 18 Sept. 1984. Y. O. 1448 (IBA-2991: U, T); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 600m, 20 Sept. 1984. Y. O. 1489 (IBA-3034: T); alt. ca. 900m, 20 Sept. 1984. Y. O. 1493 (IBA-3038: T).

*Puccinia longicornis* Patouillard & Hariot in Hariot, Bull. Soc. Mycol. Fr. 7: 143. 1891.

On *Sasa kurilensis* (Rupr.) Makino & Shibata: Rishiri Island, Minamihama, 19 Sept. 1984. Y. O. 1471. (IBA-3014: U, T); Minamihama, 4 Aug. 1991. Y. O. et al. 2448 (IBA-5804: U, T).

*Puccinia majanthemi* Dietel, Bot. Jahb. 28: 285. 1901.

On *Majanthemum dilatatum* (Wood.) Nels. & Macbr.: Rebun Island, along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1559 (IBA-3130: T); Momoiwa, 24 June 1985. Y. O. 1548 (IBA-3119: T); Mt. Rebundake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2543 (IBA-5898: T); alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2549 (IBA-5904: T); alt. ca. 450m, 4 Sept. 1989. Y. O. 1837 (IBA-3850: T); Mt. Rebundake, just below the summit, alt. ca. 490m, 7 Aug. 1991. Y. O. et al. 2558 (IBA-5913: T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 1300m, 2 Sept. 1989. Y. O. 1831 (IBA-3808: T); along Oniwaki trail, alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2434 (IBA-5790: T); along Oshidomari trail, alt. ca. 700m, 2 Aug. 1991. Y. O. et al. 2394 (IBA-5750: T); alt. ca. 1000m, 2 Aug. 1991. Y. O. et al. 2408 (IBA-5764: T).

Published records: on *Majanthemum dilatatum* (Wood) Nels. & Macbr. (as *M. bifolium* F. W. Schm. var. *kamtschaticum* Trautv. & Mey): Rebun Island, Momoiwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, 15 Aug. 1907. M. Miura (Togashi, 1924).

*Puccinia menthae* Persoon, Syn. Meth. Fung. p. 227. 1801.

On *Clinopodium chinense* (Benth.) Kuntze subsp. *grandiflorum* (Maxim.) Hara: Rebun Island, along upper stream of Rebundaki, 17 Sept. 1984. Y. O. 1434 (IBA-2977: U, T); on *Mentha arvensis* L. subsp. *haplocalyx* Brig. var. *piperascens* Malinv.: Rebun Island, along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1924 (IBA-3901: U, T).

Published record: on *Mentha arvensis* L. subsp. *haplocalyx* var. *piperascens* Malinv. (as *M. sachalinensis* Kudo: Rebun Island, Ekokinai, 11 Aug. 1922. K. Togashi (Togashi,



1924).

*Puccinia mirussensis* Thümen, Bull. Soc. Imp. Nat. Moscou 53: 214. 1878.

On *Lactuca raddeana* Maxim. var. *elata* (Hemsl.) Kitagawa: Rebus Island, along Rebus-rindo, 5 Sept. 1989. Y. O. 1898 (IBA-3875: T); along Rebus-rindo to Kafuka, 6 Aug. 1991. Y. O. et al. 2537 (IBA-5892: U, T); Mt. Rebusdake, along Nairo trail, alt. ca. 100m, 4 Sept. 1989. Y. O. 1849 (IBA-3826: U, T); alt. ca. 300m, 4 Sept. 1989. Y. O. 1863 (IBA-3840: U, T); along a trail to Kitousu, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2559 (IBA-5914: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1917 (IBA-3894: T); Rishiri Island, along a trail between Pon-yama and Himenuma, 27 June 1985. Y. O. 1569 (IBA-3140: S, A); Mt. Rishirisan, along Oshidomari trail, alt. ca. 200m, 20 Sept. 1984. Y. O. 1482 (IBA-3026: U, T).

Published records: on *Lactuca raddeana* Maxim. var. *elata* (Hemsl.) Kitagawa: Rishiri Island, Otadomari, 7 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia lactivicola* Miura); Rebus Island, Mt. Rebusdake, N. Hiratsuka (Hiratsuka, 1980).

*Puccinia miscanthi* Miura, Fl. Manchuria & E. Mongolia Pt. 3. p. 302. 1828.

Published records: on *Miscanthus sinensis* Anderss.: Rebus Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia eulaliae* Barclay); Rishiri Island, 2 Sept. 1899. T. Kawakami (Togashi, 1924: as *P. eulaliae*); on *Plantago kamschatica* Link: Rebus Island, Momoiwa, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *Aecidium plantaginis* Ces.); Uennai, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *A. plantaginis*).

*Aecidium plantaginis* Ces. is generally referred to as an aecial anamorph of *Puccinia cynodontis* Lacroix ex Desm. However, the life cycle connection between aecial anamorph on *Plantago* and teleomorph on *Cynodon* has not been proven through an inoculation experiment in Japan, as Togashi (1924) stated. On the other hand, *Aecidium* on *Plantago* spp. has been connected to *Puccinia miscanthi* through repeated inoculation experiments. Placement of Togashi's collections under *P. miscanthi* is not conclusive, and a possibility that they are an aecial anamorph of *P. cynodontis* can not be ruled out.

*Puccinia nanbuana* P. Hennings, Hedwigia Beibl. 40: (26). 1901.

On *Angelica anomala* Lallemand: Rebus Island, along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2504 (IBA-5859: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1903 (IBA-3880: U, T); along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1558 (IBA-3129: U); along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1922 (IBA-3899: U, T); 6 Sept. 1989. Y. O. 1929 (IBA-3906: U, T); along Rebus-rindo to Kafuka, 17 Sept. 1984. Y. O. 1444 (IBA-2987: U, T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1800 (IBA-3777: T); alt. ca. 300m, 1 Sept. 1989. Y. O. 1809 (IBA-3786: U, T); alt. ca. 400m, 1 Sept. 1989. Y. O. 1812 (IBA-3789: T); Kanesaki, 4 Aug. 1991. Y. O. et al. 2459 (IBA-5815: U, T); on *Angelica anomala* Lallemand var. *kawakamii* (Koidz.) Kitagawa: Rebus Island, along a trail above Rebusdake, 5 Sept. 1989. Y. O. 1895 (IBA-3872: T); at the base of Momoiwa, 5 Sept. 1989. Y. O. 1881 (IBA-3858: T); Mt. Rebusdake, along Nairo trail, alt. ca. 100m, 4 Sept. 1989. Y. O. 1852 (IBA-

3829: T); alt. ca. 200m, 4 Sept. 1989. Y. O. 1854 (IBA-3831: T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 400m, 1 Sept. 1989. Y. O. 1816 (IBA-3793: U, T); alt. ca. 1000m, 2 Sept. 1989. Y. O. 1827 (IBA-3804: U, T); on *Angelica ursina* (Rupr.) Maxim.: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2524 (IBA-5879: U, T); 5 Sept. 1989. Y. O. 1889 (IBA-3866: T); 5 Sept. 1989. Y. O. 1896 (IBA-3873: U, T); along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2484 (IBA-5839: U, T); along a trail between Rebun-rindo and Uennai, 9 Aug. 1991. Y. O. 2589 (IBA-5944: U, T); along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2472 (IBA-5828: U, T); Momoïwa, 24 June 1985. Y. O. 1549 (IBA-3120: U); Mt. Rebundake, along Nairo trail, alt. ca. 300m, 4 Sept. 1989. Y. O. 1861 (IBA-3838: T); Rishiri Island, along a trail between Pon-yama and Himenuma, 27 June 1985. Y. O. 1570 (IBA-3141: U); Wannai, 27 June 1985. Y. O. 1571 (IBA-3142: U); Kanesaki, 4 Aug. 1991. Y. O. et al. 2466 (IBA-5822: U, T); Mt. Rishirisan, along Oniwaki trail, alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2427 (IBA-5783: U, T); along Oshidomari trail, alt. ca. 1200m, 2 Aug. 1991. Y. O. et al. 2409 (IBA-5765: U, T); alt. ca. 1200m, 2 Aug. 1991. Y. O. et al. 2412 (IBA-5768: U, T); alt. ca. 800m, 2 Aug. 1991. Y. O. et al. 2395 (IBA-5751: S, A).

Published records: on *Angelica edulis* Miyabe: Rishiri Island, 15 Aug. 1907. M. Miura (Togashi, 1924: as *Puccinia angelicae-edulis* T. Miyake); on *Angelica ursina* Maxim.: Rebun Island, Kafuka, N. Hiratsuka (Hiratsuka and Kaneko, 1968); Funadomari, N. Hiratsuka (Hiratsuka and Kaneko, 1968); Rishiri Island, 2 July 1899. T. Kawakami (Togashi, 1924: as *P. angelicae-edulis*); Mt. Rishirisan, 11 Aug. 1899. T. Kawakami (T. Togashi, 1924: as *P. angelicae-edulis*); Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924: as *P. angelicae-edulis*); on *Coelopleurum gmelini* Ledeb.: Rishiri Island, Ishizaki, 7 Aug. 1922. K. Togashi (Togashi, 1924: as *P. angelicae-edulis*); Kutsugata, 8 Oct. 1923. K. Togashi (Togashi, 1924: as *P. angelicae-edulis*).

*Puccinia nishidama* P. Hennings, Hedwigia Beibl. 40: (26). 1901.

On *Cirsium kamschaticum* Ledeb.: Rebun Island, along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2471 (IBA-5827: U, T); Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2475 (IBA-5831: U, T); Rishiri Island, Minamihama, 19 Sept. 1984. Y. O. 1472 (IBA-3015: T); Mt. Rishirisan, along Kutsugata trail, alt. ca. 600m, 2 Sept. 1989. Y. O. 1822 (IBA-3799: U); on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2451 (IBA-5807: U, T); on *Cirsium* sp.: Rishiri Island, Otadomari-numa, 19 Sept. 1984. Y. O. 1477 (IBA-3020: T).

Published records: on *Cirsium kamschaticum* Ledeb. (as var. *grayanum* Maxim.): Rebun Island, Momoïwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Mt. Rebundake, N. Hiratsuka (Hiratsuka, 1980); Rishiri Island, Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924).

*Puccinia phellopteri* P. Sydow & H. Sydow, Monogr. Ured. I, p. 406. 1903.

On *Glehnia littoralis* Fr. Schmidt.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2486 (IBA-5841: U, T).

*Puccinia phragmitis* (Schumacher) Körnicke, Hedwigia 15: 179. 1876.

Published records: on *Phragmites communis* Trin.: Rebun Island, 11 Aug. 1922. K.

Togashi (Togashi, 1924); Rishiri Island, 20 Aug. 1907. M. Miura (Togashi, 1924); on *Rumex obtusifolius* L.: Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930).

*Puccinia poarum* Niessl, Bot. Tidsskr. III. 2: 34. 1877.

On *Petasites japonicus* (Sieb. & Zucc.) Maxim. var. *giganteus* (Fr. Schm.) Kitamura: Rebus Island, Motoji, 24 June 1985. Y. O. 1553 (IBA-3124: S, A).

Published records: on *Poa annua* L.: Rishiri Island, Oshidomari, 21 July 1899. T. Kawakami (Togashi, 1924); on *Petasites japonicus* Miq. var. *giganteus* Makino: Rishiri Island, Oniwaki, 14 July 1930. M. Terui (Terui, 1930).

*Petasites* plants also serve as an spermogonial-aecial host of some caricicolous puccinias in Honshu. No precise comparative study has been carried out as to aeciospore morphology among graminicolous and caricicolous puccinias whose aecial stage occur on *Petasites* plants, and thus it is not possible to identify the fungus from aeciospore characteristics. Therefore, the above collection (IBA-3124) is temporarily placed under *P. poarum*.

*Puccinia polemonii* Dietel & Holway in Dietel, Bot. Gaz. 18: 255. 1893.

Published record: on *Polemonium acutiflorum* Willd. var. *laxiflorum* (Regel.) Ohwi (as *Polemonium coeruleum* L. var. *laxiflorum* Miyabe & Kudo): Rebus Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924; Hiratsuka, 1976).

*Puccinia polygoni-sachalinensis* Patouillard & Hariot in Hariot, Bull. Soc. Mycol. Fr. 21: 84. 1905.

On *Polygonum sachalinense* Fr. Schmidt: Rebus Island, along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2510 (IBA-5865: U, T); along a trail from Rebusdaki to Rebus-rindo, 24 June 1985. Y. O. 1555 (IBA-3126: U); along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O. 1927 (IBA-3904: T); along Rebus-rindo, 5 Sept. 1989. Y. O. 1902 (IBA-3879: T); between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1417 (IBA-2960: T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 100m, 1 Sept. 1989. Y. O. 1792 (IBA-3769: U, T); alt. ca. 300m, 1 Sept. 1989. Y. O. 1804 (IBA-3781: U, T).

Published records: on *Polygonum sachalinense* Fr. Schmidt: Rebus Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia polygoni-amphibii* Persoon); Rishiri Island, Oniwaki, 1 Sept. 1899. T. Kawakami (Togashi, 1924: as *P. polygoni-amphibii*); 4 Aug. 1922. K. Togashi (Togashi, 1924: as *P. polygoni-amphibii*); Kuren, 11 Sept. 1964. N. Hiratsuka (Hiratsuka and Kaneko, 1973: as *P. polygoni-amphibii* Pers. var. *polygoni-sachalinensis*. (Pat. & Hariot) Hiratsuka, f. & S. Kaneko, comb. nov.; Mt. Rishirisan, 15 Aug. 1907. M. Miura (Togashi, 1924: as *P. polygoni-amphibii*).

Hiratsuka and Kaneko (1973) believes that number and arrangement of urediniospore germ pores are not a good taxonomic character to delimit species, but good in a varietal rank in *Puccinia polygoni-amphibii* and its allies. Accordingly, a fungus that form urediniospores with 3 (sometimes 2, rarely 5) equatorial germ pores on *Polygonum sachalinense* is treated as a variety, among others, of *P. polygoni-amphibii* whose urediniospores have 2 (sometimes 3) supraequatorial germ pores. However, so classified varieties seem to be too heterogeneous to consist a single species. The

varieties, *polygoni-sachalinensis* (urediniospores with 3 equatorial pres), *polygoni-caespitosii* (urediniospores with 2 basal pores), and *polygoni-sieboldii* (urediniospores with one apical pore), should be given a specific rank.

*Puccinia punctata* Link, Mag. Ges. Naturf. Fr. Berlin 7: 30. 1815.

On *Galium nakaii* Kudo ex Hara: Rebun Island, Gorotamisaki, 18 Sept. 1984. Y. O. 1449 (IBA-2992: T).

Published records: on *Asperula odorata* L.: Rishiri Island, Oniwaki, T. Kawakami (Togashi, 1924: as *Puccinia asperulae-odoratae* Wurtth.); Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924: as *P. asperulae-odoratae*); on *Galium verum* L.: Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930).

*Puccinia pygmaea* Eriksson, Bot. Centralbl. 64: 381. 1895.

Published record: on *Calamagrostis epigejos* Roth. (as var. *densiflora* Ledeb.): Rishiri Island, 15 Aug. 1907. M. Miura (Togashi, 1924: as *Puccinia ishikawai* S. Ito).

*Puccinia rangiferina* S. Ito, J. Coll. Agr. Tohoku Imp. Univ. 3: 194. 1909.

Published record: on *Calamagrostis epigejos* Roth. (as var. *densiflora* Ledeb.): Rishiri Island, Kutsugata, 8 Oct. 1923. K. Togashi (Togashi, 1924: as *Puccinia epigejos* S. Ito).

*Puccinia recondita* Roberge ex Desmazieres, Bull. Soc. Bot. France 4: 798. 1857.

On *Cimicifuga simplex* Wormsk. var. *ramosa* Maxim.: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 400m, 2 Aug. 1991. Y. O. et al. 2389 (IBA-5745: S, A); on *Thalictrum minus* L. var. *hypoleucum* (Sieb. & Zucc.) Miq.: Rebun Island, along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1563 (IBA-3134: S, A); along a trail from Rebundaki to Rebun-rindo, 24 June 1985. Y. O. 1554 (IBA-3125: S, A); on *Elymus dahuricus* Turczaninow: Regun Island, Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2479 (IBA-5834: U).

Published records: on *Agropyron tsukushiense* (Honda) Ohwi var. *transiens* (Hackel) Ohwi (as *A. semiconstatum* Nees.): Rishiri Island, Sempoji, 1 Sept. 1899. T. Kawakami (Togashi, 1924: as *Puccinia baryi* (Berkeley & Broome) Winter); on *Agropyron repens* (L.) P. Beauv. (as *Brachypodium japonicum* Miq.): Rebun Island, Kafuka, 12 Oct. 1923. K. Togashi (Togashi, 1924: as *Puccinia brachysora* Dietel); on *Cimicifuga simplex* Wormsk. var. *ramosa* Maxim. (as *Cimicifuga foetida* L. var. *intermedia* Regel.): Rishiri Island, Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924: as *Aecidium kusamoi* Dietel); on *Thalictrum minus* L. var. *elatum* Lecov.: Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930: as *Puccinia triticina* Eriks).

Spermogonia and aecia on *Cimicifuga* spp. has generally been referred to as an aecial anamorph of *Puccinia recondita*, but Cummins (1971) cited Tranzschel's inoculation experiment where basidiospores of *Puccinia triseticola* Tranzschel infected the plants of *Cimicifuga daurica* and spermogonia were formed, but the plants died before aecia developed. A possibility that the spermogonial-aecial state on *Cimicifuga simplex* found in Hokkaido is connected to the uredinial-telial state of *P. triseticola* on *Trisetum* can not be ruled out.

*Puccinia ribis* de Candolle, Fl. Fr. 2: 221. 1805.

Published record: on *Ribes latifolium* Jacz.: Rishiri Island, 15 Aug. 1907. M. Miura (Togashi, 1924).

The above-cited specimen seems to be only record of this alpine microcyclic species in Japan.

*Puccinia rubiae-tataricae* H. Sydow & P. Sydow, Ann. Mycol. 11: 98. 1913.

Published record: on *Rubia yezoensis* (Miq.) Miyabe & Miyake: Rebus Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924).

In Japan, this fungus is known only in Hokkaido.

*Puccinia schizonepetae* Tranzschel ex Ganecsin, Trav. Mus. Bot. Acad. Imp. Sci. St. Petersb. 10: 203. 1913.

Published records: on *Nepeta subsessilis* Maxim. (as var. *yezoensis* Fr. & Sav.): Rebus Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia nepetae* Togashi, sp. nov.; Hiratsuka, 1976); 12 Oct. 1923. K. Togashi (Togashi, 1924: as *P. nepetae* Togashi, sp. nov.; Hiratsuka, 1976).

*Puccinia senecionis* Libert, Pl. Crypt. Arduenna I. no. 92. 1830.

Published records: on *Senecio cannabinifolius* Less. (as *Senecio palmatus* Pall.): Rebus Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *Puccinia subcircinata* Ellis & Schumacher; Hiratsuka, 1980); Rishiri Island, Oniwaki, 4 Aug. 1922. K. Togashi (Togashi, 1924: as *P. subcircinata*; Hiratsuka, 1980).

*Puccinia sessilis* Schneider in Schröter, Abh. Schles. Ges., Naturw. Abth. 1869-1872: 19. 1870.

On *Polygonatum lasianthum* Maxim.: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 100m, 3 Aug. 1991. Y. O. et al. 2420 (IBA-5776: S, A); alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2435 (IBA-5791: S, A).

Published records: on *Phalaris arundinacea* L.: Rebus Island, Tomochi, 10 Aug. 1922. K. Togashi (Togashi, 1924); on *Orchis aristata* Fisch.: Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930).

*Puccinia sibirica* Tranzschel in Tranzschel & Serebrian, Myc. Ross. exsicc. no. 160. 1911.

Published record: on *Polygonum ajanense* (Regel. & Tiling) Grig. (as *P. polymorphum* Ledeb. var. *ajanense* Regel. f. *pilosum* Takeda): Rebus Island, Momoiva, 17 July 1930. M. Terui (Terui, 1930).

*Puccinia silvatica* Schröter, Cohn Beitr. Biol. Pfl. 3: 68. 1879.

Published record: on *Carex middendorffii* Fr. Schmidt: Rishiri Island, Sempoji, 8 Oct. 1923. K. Togashi (Togashi, 1924).

*Puccinia sonchi-arvensis* Tokunaga & Kawai in Kawai and Otani, Trans. Sapporo Nat. Hist. Soc. 11: 235. 1931.

Published record: on *Sonchus brachyotus* DC. (as *S. arvensis* L. var. *uliginosus*



Trautv.): Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930: as *Puccinia sonchi* (Rob.) Desm.).

The specimens of this species so far collected in Japan are all from Hokkaido.

*Puccinia stipae-sibiricae* S. Ito, J. Col. Agr. Tohoku Imp. Univ. 3: 228. 1909.

On *Sedum ishidae* Miyabe & Kudo: Rebun Island, Momoiwa, 24 June 1985. Y. O. 1552 (IBA-3123: S, A).

This species was merged with *Puccinia stipae* Arthur on the basis of their morphological similarity and treated as its variety (Greene and Cummins, 1958). Aecial anamorph of *P. stipae* occurs on *Aster* (Compositae), while that of *P. stipae-sibiricae* on *Sedum* (Grossulariaceae). Even if these two taxa have a close phylogenetical relation, they are better treated as distinctive species because they are reproductively separated, i.e. they form their spermogonial-aecial stage on separate host species. In Japan, this species is known only in Hokkaido.

*Puccinia umbilici* Guépin ex Duby, Bot. Gall. 2: 890. 1830.

Published record: on *Sedum rosea* (L.) Scop.: Rishiri Island, Mt. Rishirisan, 3 Aug. 1899. T. Kawakami (Hiratsuka, 1976).

Kawakami's collection from Mt. Rishiri is the only Japanese record of this circumpolar microcyclic species.

*Puccinia vesiculosa* Schlechtendal ex Ehrenberg in Nees, Esenbeck Horae Phys. Berolin., p. 97. 1820.

Published records: on *Anemone narcissiflora* (L.) Scop.: Rishiri Island, Mt. Rishirisan, T. Kawakami (Kawakami, 1900: as *P. schelliana* Thümen); 1, 11 & 21 Aug. 1899. T. Kawakami (Togashi, 1924).

*Puccinia violae* de Candolle, Fl. Fr. 6: 62. 1815.

On *Viola sachalinensis* H. Boiss.: Rebun Island, along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2498 (IBA-5853: U, T); along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1908 (IBA-3885: U, T); 6 Sept. 1989. Y. O. 1914 (IBA-3891: U, T); at the base of Momoiwa, 18 Sept. 1984. Y. O. 1467 (IBA-3010: U, T); Rishiri Island, along a trail between Pon-yama and Himenuma, 27 June 1985. Y. O. 1568 (IBA-3139: S, A); Mt. Rishirisan, along Oshidomari trail, alt. ca. 300m, 20 Sept. 1984. Y. O. 1483 (IBA-3028: U, T); alt. ca. 400m, 20 Sept. 1984. Y. O. 1486 (IBA-3031: U, T).

Published records: on *Viola grypoceras* A. Gray: Rebun Island, Momoiwa, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924).

*Pucciniastrum agrimoniae* (Dietel) Tranzschel. Scripta Bot. Hort. Univ. Imp. Petrop. 4: 301. 1895.

On *Agrimonia pilosa* Ledeb.: Rebun Island, along a trail above Rebundaki, 6 Aug. 1991. Y. O. et al. 2530 (IBA-5885: U); along a trail between Shiretoko and Motoji Lighthouse, 17 Sept. 1984. Y. O. 1420 (IBA-2963: U); 8 Aug. 1991. Y. O. et al. 2563 (IBA-5918: U); along a trail on north-west shore of the Kushuko, 6 Sept. 1989. Y. O.

1925 (IBA-3902: U); along Rebut-rindo to Kafuka, 17 Sept. 1984. Y. O. 1445 (IBA-2988: U); along Horonari River to Hamanaka, 6 Sept. 1989. Y. O. 1921 (IBA-3898: U); Mt. Rebundake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2538 (IBA-5893: U); alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2551 (IBA-5906: U); alt. ca. 300m, 4 Sept. 1989. Y. O. 1857 (IBA-3834: U); alt. ca. 400m, 4 Sept. 1989. Y. O. 1865 (IBA-3842: U); on a trail from Nishiuedomari to Horonai River, 18 Sept. 1984. Y. O. 1456 (IBA-2999: U); Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 100m, 3 Aug. 1991. Y. O. et al. 2419 (IBA-5775: U).

Published records: on *Agrimonia pilosa* Ledeb.: Rishiri Island, 25 Aug. 1894. K. Miyabe (Togashi, 1924); Oshidomari, 3 Aug. 1899. T. Kawakami (Togashi, 1924); Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924).

*Pucciniastrum epilobii* Otth, Mitt. Naturf. Ges. Bern 1861: 72 & 84. 1861.

Published record: on *Epilobium angustifolium* L.: Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924).

*Pucciniastrum potentillae* Komarov in Jaczewski, Komarov & Tranzschel, Fung. Ross. exsicc. no. 327. 1900.

On *Potentilla fragarioides* L. var. *major* Maxim.: Rebut Island, at the base of Momoia, 5 Sept. 1989. Y. O. 1883 (IBA-3860: U).

Published record: on *Potentilla fragarioides* L. var. *major* Maxim.: Rebut Island, Momoia, 16 July 1930. M. Terui (Terui, 1930).

*Pucciniostele clarkiana* (Barclay) Dietel, Bot. Jahb. 27: 564. 1899.

Published record: on *Astilbe thunbergii* Miq. var. *congesta* Boiss.: Rebut Island, Momoia, 17 July 1930. M. Terui (Terui, 1930).

*Thekopsora guttata* (Schröter) P. & H. Sydow, Monogr. Ured. III, p. 467. 1915.

On *Galium trifloriforme* Komarov: Rebut Island, along upper stream of Rebundaki, 17 Sept. 1984. Y. O. 1435 (IBA-2978: U, T); Mt. Rebundake, along a trail from Nairo, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2550 (IBA-5905: U).

*Thekopsora vaccinii* (Winter) Hiratsuka, f., Ured. Stud. p. 260. 1955.

On *Vaccinium ovalifolium* J. E. Smith var. *coriaceum* H. Boiss.: Rebut Island, along a trail above Rebundaki, 5 Sept. 1989. Y. O. 1894 (IBA-3871: U); 6 Aug. 1991. Y. O. et al. 2529 (IBA-5884: U); Mt. Rebundake, along a trail from Nairo, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2552 (IBA-5907: U); alt. ca. 300m, 4 Sept. 1989. Y. O. 1860 (IBA-3837: U).

Published record: on *Vaccinium vitis-idaea* L.: Rebut Island, Momoia, 12 Aug. 1923. K. Togashi (Togashi, 1924: as *Thekopsora vacciniorum* Karsten).

*Triphragmium ulmariae* (de Candolle) Link in Linnaeus, Sp. Pl. Ed. 4, 6: 84. 1825.

On *Filipendula kamschatica* (Pall.) Maxim.: Rebut Island, along a trail between Rebut-rindo and Uennai, 9 Aug. 1991. Y. O. 2584 (IBA-5939: T).

Published records: *Filipendula kamschatica* (Pall.) Maxim.: Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924).

*Uredinopsis filicina* Magnus, Atti Congr. Bot. Internat. Genova, p. 167. 1893.

On *Phegopteris polypodioides* Fée: Rebus Island, along a trail above Rebusdaki, 5 Sept. 1989. Y. O. 1893 (IBA-3870: U); along a trail between Rebus-rindo and Uennai, 9 Aug. 1991. Y. O. 2581 (IBA-5936: U); Mt. Rebusdake, along a trail from Nairo, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2554 (IBA-5909: U); Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 400m, 2 Aug. 1991. Y. O. et al. 2391 (IBA-5747: U).

Published record: on *Phegopteris polypodioides* Fée: Rebus Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924).

*Uredinopsis intermedia* Kamei, Trans. Sapporo Nat. Hist. Soc. 12: 166. 1932.

On *Athyrium* sp.: Rishiri Island, Otadomari-numa, 19 Sept. 1984. Y. O. 1473 (IBA-3016: U).

*Uredo iyoensis* Hiratsuka, f. & Yoshinaga, Mem. Tottori Agr. Coll. 3: 334. 1935.

On *Viola biflora* L.: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 1400m, 2 Sept. 1989. Y. O. 1838 (IBA-3815: U); alt. ca. 1200m, 20 Sept. 1984. Y. O. 1499 (IBA-3044: U); on *Viola selkirkii* Pursh: Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2442 (IBA-5798: U); along Oshidomari trail, alt. ca. 1100m, 2 Aug. 1991. Y. O. et al. 2405 (IBA-5761: U).

*Uredo nervicola* Tranzschel, Ann. Mycol. 5: 551. 1907.

On *Potentilla fragarioides* L. var. *major* Maxim.: Rebus Island, along a trail between Nishiuedomari and Meshiguni, 6 Sept. 1989. Y. O. 1912 (IBA-3889: U); along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1562 (IBA-3133: U); along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1459 (IBA-3002: U); along Rebus-rindo, 5 Sept. 1989. Y. O. 1899 (IBA-3876: U); around Momoiva, alt. ca. 200m, 5 Sept. 1989. Y. O. 1877 (IBA-3854: U); 24 June 1985. Y. O. 1550 (IBA-3121: U); at the base of Momoiva, 17 Sept. 1984. Y. O. 1427 (IBA-2970: U); 5 Sept. 1989. Y. O. 1886 (IBA-3863: U); 17 Sept. 1984. Y. O. 1431 (IBA-2974: U); Mt. Rebusdake, along a trail from Nairo, alt. ca. 100m, 7 Aug. 1991. Y. O. et al. 2541 (IBA-5896: U).

*Uromyces cacaliae* (de Candolle) Unger, Einfl. Bod. Vert. Gew. p. 216. 1836.

On *Cacalia auriculata* DC. var. *kamtschatica* Matsumura: Rebus Island, along a trail from Kafukai to Uennai, 25 June 1985. Y. O. 1560 (IBA-3131: T).

*Uromyces geranii* (de Candolle) Léveillé, Ann. Sci. Bot. III. 8: 371. 1847.

On *Geranium erianthum* DC.: Rebus Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2494 (IBA-5849: T); at the base of Momoiva, 5 Sept. 1989. Y. O. 1879 (IBA-3856: T); 17 Sept. 1984. Y. O. 1429 (IBA-2972: U, T); along a trail between Shiretoko and Motoji Lighthouse, 8 Aug. 1991. Y. O. et al. 2566 (IBA-5921: T); along a trail above Rebusdaki, 6 Aug. 1991. Y. O. et al. 2526 (IBA-5881: U, T); Gorotamisaki, 18 Sept. 1984. Y. O. 1451 (IBA-2994: T); 5 Aug. 1991. Y. O. et al. 2478 (IBA-5833: U, T); along a trail above Rebusdaki, 5 Sept. 1989. Y. O. 1891 (IBA-3868: T).

Published records: on *Geranium erianthum* DC.: Rebus Island, Momoiva, 9 Aug. 1922. K. Togashi (Togashi, 1924); 12 Oct. 1923. K. Togashi (Togashi, 1924); Kafuka, K.

Togashi (Hiratsuka, 1973); Momoïwa, M. Terui (Hiratsuka, 1973).

*Uromyces hedysari-obscuri* Carestia & Piccone, Critt. Ital. Ed. 2, Fasc. 9, no. 447. 1871.

On *Hedysarum hedysarioides* (L.) Schinz & Thell.: Rebun Island, at the base of Momoïwa, 17 Sept. 1984. Y. O. 1425 (IBA-2968: U, T); 18 Sept. 1984. Y. O. 1468 (IBA-3011: T); along Rebun-rindo to Kafuka, 6 Aug. 1991. Y. O. et al. 2535 (IBA-5890: U, T); 6 Aug. 1991. Y. O. et al. 2536 (IBA-5891: U, T); along upper stream of Rebundaki, 17 Sept. 1984. Y. O. 1437 (IBA-2980: U, T).

Published records: on *Hedysarum hedysarioides* (L.) Schinz. & Thell. (as *Hedysarum obscurum* L. var. *neglectum* Trautv.): Rebun Island, Momoïwa, 16 July 1930. M. Terui (Terui, 1930; Hiratsuka, 1973).

*Uromyces japonicus* Berkeley & Curtis, Proc. Amer. Acad. Arts & Sci. 4: 126. 1858.

On *Allium victorialis* L. subsp. *platyphyllum* Hultén: Rishiri Island, Mt. Rishirisan, along Oshidomari trail, alt. ca. 800m, 2 Aug. 1991. Y. O. et al. 2396 (IBA-5752: T).

Published records: on *Allium victorialis* L. subsp. *platyphyllum* Hultén: Rishiri Island, T. Kawakami (Kawakami, 1900: as *Uromyces acutatus* Fuckel); Mt. Rishirisan, 13 Aug. 1899. T. Kawakami (Togashi, 1924); Aug. 1907. M. Miura (Togashi, 1924).

*Uromyces muehlenbergiae* S. Ito, J. Tohoku Imp. Univ. Coll. Agr. 3: 186. 1909.

Published record: on *Muehlenbergia japonica* Steud.: Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930).

*Uromyces peracarpae* S. Ito & Tochinai in Ito, Bot. Mag. Tokyo 40: 278, 1926.

Published record: on *Peracarpa carnosae* (Wall.) Hook., f. & Thomas var. *circaeoides* (Fr. Schm.) Makino: Rishiri Island, Mt. Rishirisan, 15 July 1930. M. Terui (Terui, 1930).

Several collections of this fungus have been made only in Hokkaido, and the above cited specimen is the only record of this fungus in the Island. Outside Japan, this species is distributed in Sakhalin and the Kurile Islands.

*Uromyces polygoni-arviculare* (Persoon) Karsten, Bidr. Känned. Finl. Nat. Folk 4: 12. 1879.

On *Polygonum arviculare* L.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2489 (IBA-5844: U); Rishiri Island, Oshidomari, 26 June 1985. Y. O. 1564 (IBA-3135: U).

Published records: on *Polygonum aviculare* L.: Rebun Island, Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924: as *Uromyces polygoni* (Pers.) Kuck.); Rishiri Island, 1 Aug. 1899. T. Kawakami (Togashi, 1924: as *U. polygoni*); 20 Aug. 1907. M. Miura (Togashi, 1924: as *U. polygoni*); Oniwaki, 7 Aug. 1922. K. Togashi (Togashi, 1924: as *U. polygoni*).

*Uromyces rudbeckiae* Arthur & Holway, Bull. Iowa Agr. Coll. 1884: 154. 1885.

Published records: on *Solidago virgaurea* L.: Rebun Island, Aug. 1897. T. Nishida

(Togashi, 1924); Uennai, 10 Aug. 1922. K. Togashi (Togashi, 1924).

*Uromyces sommerfeltii* Hylander, Joerstad & Nannfeldt, Opera Bot. 1: 96. 1953.

On *Solidago virgaurea* L.: Rebun Island, Mt. Rebundake, along a trail from Nairo, alt. ca. 300m, 7 Aug. 1991. Y. O. et al. 2546 (IBA-5901: T); alt. ca. 400m, 7 Aug. 1991. Y. O. et al. 2556 (IBA-5911: T); alt. ca. 400m, 4 Sept. 1989. Y. O. 1864 (IBA-3841: T); alt. ca. 450m, 4 Sept. 1989. Y. O. 1869 (IBA-3846: T); Rishiri Island, Mt. Rishirisan, along Kutsugata trail, alt. ca. 900m, 2 Sept. 1989. Y. O. 1825 (IBA-3802: T); along Oniwaki trail, alt. ca. 900m, 2 Sept. 1989. Y. O. 1825 (IBA-3802: T); along Oniwaki trail, alt. ca. 400m, 3 Aug. 1991. Y. O. et al. 2439 (IBA-5795: T); along Oshidoamri trail, alt. ca. 1100m, 2 Aug. 1991. Y. O. et al. 2406 (IBA-5762: T); alt. ca. 1200m, 2 Aug. 1991. Y. O. et al. 2410 (IBA-5766: T); alt. ca. 1300m, 2 Aug. 1991. Y. O. et al. 2416 (IBA-5772: T).

Published records: on *Solidago virgaurea* L.: Rishiri Island, T. Kawakami (Kawakami, 1900: as *Uromyces solidaginis* (Sommerf.) Niessl.); 1 Aug. 1899. T. Kawakami (Togashi, 1924: as *U. solidaginis*); 15 Aug. 1907. M. Miura (Togashi, 1924: as *U. solidaginis*); Mt. Rishirisan, 5 Aug. 1922. K. Togashi (Togashi, 1924: as *U. solidaginis*).

*Uromyces trifolii-repentis* Liro, Bidr. Känned. Finl. Nat. Folk 65: 94. 1908. var. *fallens* (Arthur) Cummins, Mycotaxon 5: 407. 1977.

On *Trifolium pratensis* L.: Rishiri Island, Kanesaki, 4 Aug. 1991. Y. O. et al. 2461 (IBA-5817: U); on a trail around the Otadomari-numa, 4 Aug. 1991. Y. O. et al. 2454 (IBA-5810: U).

*Uromyces trifolii-repentis* Liro, Bidr. Känned. Finl. Nat. Folk 65: 94. 1908. var. *trifolii-repentis*

On *Trifolium repens* L.: Rebun Island, along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2468 (IBA-5824: U); Rishiri Island, Mt. Rishirisan, along Oniwaki trail, alt. ca. 300m, 3 Aug. 1991. Y. O. et al. 2432 (IBA-5788: U).

Published records: on *Trifolium repens* L.: Rebun Island, Momoïwa, 16 July 1930. M. Terui (Terui, 1930); Rishiri Island, Otadomari, 14 July 1930. M. Terui (Terui, 1930).

*Uromyces veratri* (de Candolle) Schröter, Abh. Schles. Ges. vaterl. Kult 48: 10. 1869.

Published record: on *Veratrum album* L. subsp. *oxysepalum* Hultén (as *V. album* L. var. *grandiflorum* Maxim.): Rebun Island, Momoïwa, 16 July 1930. M. Terui (Terui, 1930).

*Uromyces viciae-fabae* Schröter, Hedwigia 14: 161. 1857.

On *Lathyrus maritimus* (L.) Bigel.: Rebun Island, along a trail between Gorotamisaki and Teppu, 5 Aug. 1991. Y. O. et al. 2487 (IBA-5842: U); along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1461 (IBA-3004: U, T); on *Vicia japonica* A. Gray: Rebun Island, along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2473 (IBA-5829: U); along Rebun-rindo, 5 Sept. 1989. Y. O. 1901 (IBA-



3878: U, T); Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2481 (IBA-5836: U); on a trail from Nishiuedomari to Horonai River, 18 Sept. 1984. Y. O. 1458 (IBA-3001: U); along Horonai River to Hamanaka, 18 Sept. 1984. Y. O. 1465 (IBA-3008: U, T).

Published records: on *Vicia japonica* A. Gray (as *V. japonica* A. Gray f. *sylvatica* Komarov): Rishiri Island, Oshidomari, 10 Oct. 1923. K. Togashi (Togashi, 1924: as *Uromyces fabae* (Pers.) de Bary; Hiratsuka, 1973).

*Uromyces yatsugatakensis* Hiratsuka, f., Mem. Tottori Agr. Coll. 3: 147 & 189. 1935.

On *Hedysarum hedysarioides* Schniz & Thell.: Rebun Island, along a trail between Motoji Lighthouse and Momoiva, 8 Aug. 1991. Y. O. et al. 2573 (IBA-5928: U, T).

*Xenodochus carbonarius* Schlechtendal, Linnaea 1: 237. 1826.

On *Sanguisorba tenuifolia* Fisch. var. *tenuifolia* f. *alba*: Rebun Island, along a trail between Nishiuedomari and Meshiguni, 5 Aug. 1991. Y. O. et al. 2500 (IBA-5855: T); 5 Aug. 1991. Y. O. et al. 2508 (IBA-5863: U, T); along a trail between Shiretoko and Motoji Lighthouse, 8 Aug. 1991. Y. O. et al. 2565 (IBA-5920: U, T); along Rebun-rindo to Kafuka, 6 Aug. 1991. Y. O. et al. 2533 (IBA-5888: U, T); along a trail between Sukotonmisaki and Gorotamisaki, 5 Aug. 1991. Y. O. et al. 2474 (IBA-5830: U, T).

Published records: on *Sanguisorba tenuifolia* Fisch. var. *tenuifolia* f. *alba* (as *Sanguisorba tenuifolia* Fisch. var. *alba* Trautv. & Mey): Rebun Island, Kafuka, 9 Aug. 1922. K. Togashi (Togashi, 1924); Rishiri Island, July 1899. T. Kawakami (Togashi, 1924).

## Discussion

The Rishiri and the Rebun are the northernmost islands of Japan, the former being located at 45.11° N, 141.15° E and the latter at 45.23° N, 141.02° E. Mt. Rishirisan, 1719 m above sea level, constitutes the Rishiri Island, and is composed of a main stratovolcano and many parasitic volcanoes originated on the Tertiary basement rocks (Kobayashi, 1987). Although exactly when the volcanic eruption started is unknown, the younger stage of repeated eruptions is estimated to start ca. 20000 years ago and ceased ca. 3500 years ago. Mt. Rishirisan is characterized by repeated eruptions of lavas and cones of various chemical nature (Kobayashi, 1987). A large portion of the Island below ca. 600 m is covered by a fan deposit and others by lavas of mainly basaltic nature (with a small amounts of andesite and rhyolite). A significant portion above ca. 600 m is covered by rocks of olivine-free pyroxene andesite, and some isolated portions by olivine-bearing pyroxene andesite (with a small amount of basalt). On the other hand, the Rebun Island consists of the early Cretaceous volcanic products of five different formations: 'Jizoiwa', 'Uennai', 'Anama', 'Nairo', and 'Rebundake', each being characterized by predominant assemblages of brecciated lavas, agglomerates, volcanic breccias, volcanogenic sediments and/or volcanic conglomerates (Ikeda and Komatsu, 1986). Almost all the volcanic products are andesite with certain amount of basalt of island arc tholeiitic affinity. The Rebun is a gently undulating hilly island with the highest peak, Mt.

Rebundake, of 490 m above sea level. Soil type of both Islands is generally referred to as a volcanogenous regosol.

Paleogeography of the Rishiri and the Rebun is interpreted as follows (Minato, 1974): basic topography of the Islands seems to have been constructed by the Tertiary volcanic products by Pliocene. During the period from mid Pliocene through early Pleistocene (approximately 2 million years ago), a major part of the mainland of Hokkaido and both Islands were continuous to the Eurasian Continent through Sakhalin. The Islands and Hokkaido became isolated during repeated glacial and interglacial periods (eight hundred thousand to one hundred and fifty thousand years ago). Both Islands had never submerged under the sea throughout the periods. Both Islands and Hokkaido again became connected to the Continent due to regression of the sea during the Riss-Würm interglaciation to the Würm glaciation periods in late Pleistocene (to ten thousand years ago). Hokkaido was continuous also to Honshu through a narrow isthmus. This is the period during which Mt. Rishirisan repeatedly erupted to conform current topology. By Holocene (approximately ten thousand years ago), through transgression of the sea, both Islands and Hokkaido established their conformations that are currently observed.

These paleogeographic events indicates that floras of both Islands were founded in the period from late Pliocene through early Pleistocene and modified in late Pleistocene through repeated migration of plants both from the Continent and from Hokkaido and successive climatic changes. *Abies veitchii* Lindl., *Abies* sp., *Picea glehnii* (Gr. Schm.) Mast., *P. jezoensis* (Sieb. & Zucc.) Carr., *Larix gmelinii* (Rupr.) Kuz., *Alnus japonica* (Thunb.) Steud., *Fagus crenata* Blume, *Juglans sieboldiana* Maxim., *Magnolia kobus* DC., *Styrax japonica* Sieb. & Zucc., and *S. obassia* Sieb. & Zucc. predominated in various Pleistocene strata as shown by fossil and pollen analyses in various localities in Hokkaido (Yano, 1987). These show that a very basis of currently observed flora of Hokkaido was founded by the end of Pleistocene, from which time the Islands became completely isolated and remained so throughout Holocene. This explains the similarity of floras between the Rishiri and the Rebun. Tatewaki (1941) listed 512 species of vascular plants for the Rishiri Island, only 39 species of which were stated not to be found in the Rebun Island. Only 26 species found in the Rebun were stated not to be found in the Rishiri. Six species are endemic to the Rishiri Island.

One hundred and twenty-four rust taxa were found to be distributed in the Islands: 91 in the Rishiri and 88 in the Rebun. Fifty-five taxa are common to both Islands. This apparent difference of rust floras between the Rishiri and the Rebun is not due to the different distribution of actual and potential host plants in the Island. As mentioned above, the floras of both Islands are essentially the same. The difference in rust floras is thought to reflect simply the incompleteness of field surveys and collections. Alternative interpretation of the difference may be as follows: 1) Geographic distribution of rust fungi in a given region is not literally continuous or uniform, as often empirically known from field observations and collections. This was perhaps true for a region covering the Rishiri and the Rebun before the Islands became completely isolated from the Continent and Hokkaido some ten thousand years ago. 2) When the Island became isolated, rust fungi that remained in each Island were those distributed there by different conditions of vegetation or

by chance. 3) Uneven distribution of rust fungi has since been retained with little changes. 4) Topological differences between the Islands might have reinforced the differential development of vegetations between the Islands, resulting in the differential development of rust floras. Even if the plant species composition is the same for two adjacent regions, differences in frequency and population density of each plant species will result in different vegetation types. Low frequency and low population density of potential host plant(s) may not permit their rust parasite(s) to successfully migrate and infect because propagules of the rust(s) are essentially wind-borne and because landing of the propagules on appropriate host plant(s) is entirely accidental. In order for heteroecious rusts, especially, to complete their life cycle and to perpetuate in a given area, their spermogonial-aecial and uredinial-telial hosts must be present abundantly in sufficiently close proximity. If these conditions are not fulfilled, many rust fungi would not be able to distribute in the area even though their potential hosts are present there.

Nevertheless, mycofloristically both Islands are included in the same region as Hokkaido. Only *Melampsora arctica*, *Puccinia ribis*, *P. umbilici*, and *Uromyces peracarpae* are known in the Island, but not in the mainland of Hokkaido. Japanese distribution records of 13 rust taxa, i.e. *Arthuriomyces peckianus*, *Endocronartium sahoanum* var. *hokkaidoense*, *E. yamabense*, *Melampsora arctica*, *Miyagia pseudosphaeria*, *Phragmidium rubi-idaei*, *Puccinia adoxae*, *P. ribis*, *P. rubiae-tataricae*, *P. sonchi-arvensis*, *P. stipae-sibiricae*, *P. umbilici*, and *Uromyces peracarpae*, are known only from Hokkaido. Although most rust taxa found in the Islands are known to be distributed not only in Hokkaido but also in Honshu and southward, approximately 40 % are the taxa of either alpine or arctic distribution. Rust taxa of microcyclic life cycle, which is generally considered to be a short season adaptation, constitute approximately 20 % of the rust flora.

One hundred and fourteen out of 124 rust taxa found in the Islands are known to be distributed in the Far Eastern region of Russia (Azubukina, 1984), and 96 in China (Tai, 1979), whereas only 60 taxa are distributed commonly in North America (Cummins and Stevenson, 1956). The following 38 taxa are of typical eastern-Asiatic distribution: *Coleosporium cimicifugatum*, *C. lycopi*, *C. neocacaliae*, *C. parvisporum*, *C. phellodendri*, *C. saussureae*, *Cronartium kantschaticum*, *Endocronartium sahoanum* var. *hokkaidoense*, *E. yamabense*, *Melampsora kusanoi*, *Melampsorella itoana*, *Melampsoridium alni*, *Milesina miyabei*, *Nyssopsora asiatica*, *Phragmidium rubi-japonici*, *Puccinia adenophorae*, *P. baicalensis*, *P. calumnata*, *P. caricis-molliculae*, *P. erythropus*, *P. infra-aequatorialis*, *P. lactucae-debilis*, *P. lactucae-repentis*, *P. ligusticola*, *P. majanthemi*, *P. miscanthi*, *P. nambuana*, *P. nishidana*, *P. phellopteri*, *P. polygoni-sachalinensis*, *P. rubiae-tataricae*, *P. sonchi-arvensis*, *P. stipae-sibiricae*, *Uredo iyoensis*, *U. nervicola*, *Uromyces japonicus*, *U. muehlenbergiae*, *U. peracarpae*, and *U. yatsugatakense*. Majority of rust taxa commonly found in the Islands and North America are either those of circumpolar distribution or cosmopolitan, and only a few are of Eurasian-American distribution. The taxa of typical Asiatic-North American distribution are *Phragmidium montivagum*, *Puccinia festucae*, *P. haleniae*, *P. senecionis*, *Pucciniastrum potentillae*, *Uromyces geranii*, *U. hedysari-obscuri*, *U. rudbeckiae*, and *U. sommerfeltii*. Among these, *Melampsoridium alni*, *Puccinia calumnata*, *P. senecionis*,

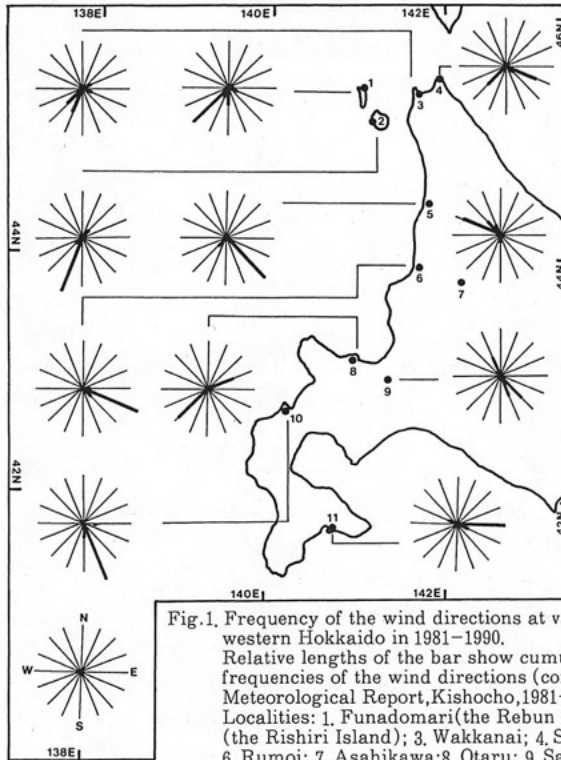


Fig.1. Frequency of the wind directions at various localities of western Hokkaido in 1981-1990. Relative lengths of the bar show cumulative monthly frequencies of the wind directions (compiled from the Meteorological Report, Kishocho, 1981-1990). Localities: 1. Funadomari (the Rebun Island); 2. Kutsugata (the Rishiri Island); 3. Wakkanai; 4. Soyamisaki; 5. Haboro; 6. Rumoi; 7. Asahikawa; 8. Otaru; 9. Sapporo; 10. Suttsu; 11. Hakodate.

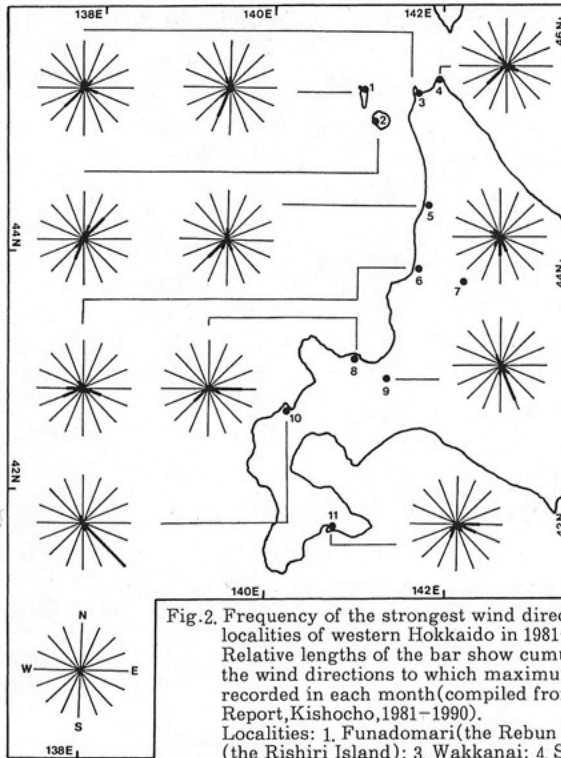


Fig.2. Frequency of the strongest wind directions at various localities of western Hokkaido in 1981-1990. Relative lengths of the bar show cumulative frequencies of the wind directions to which maximum velocity was recorded in each month (compiled from the Meteorological Report, Kishocho, 1981-1990). Localities: 1. Funadomari (the Rebun Island); 2. Kutsugata (the Rishiri Island); 3. Wakkanai; 4. Soyamisaki; 5. Haboro; 6. Rumoi; 7. Asahikawa; 8. Otaru; 9. Sapporo; 10. Suttsu; 11. Hakodate.

*Uredo iyoensis*, *Uromyces hedysari-obscuri*, and *U. sommerfeltii* extend their distribution to the Himalayas. The similarity of the rust flora of the Islands to that of the Russian Far East and China and the dissimilarity to North America are interpreted largely by paleogeographical events by which topology and flora of the Islands were founded.

The rust flora of the Rishiri and the Rebun must have been founded in the course of the floral development of vascular plants, which are either actual or potential hosts for the rusts, by Holocene. However, it is probable that rusts have since migrated to the Islands from Hokkaido and from the Far Eastern region of the Continent by a long-distance wind dispersal of the spores, although chance and frequency of the dispersal may be exceedingly low. The following may be examples of the actual long-distance wind dispersal of rust fungi. Eight *Coleosporium* species found in the Islands are heteroecious in their life cycle; their spermgonial-aecial stage occurs on *Pinus* spp. and uredinial-telial stage on various dicots. Although they form vegetative, repeating spores (urediniospores) to increase population size and to persist in the absence of alternate hosts (*Pinus* spp.), they seem to be obligately heteroecious in the Islands. Their uredinial-telial stage occurs on leaves of herbaceous perennial plants or deciduous trees, and the vegetative urediniospores are not capable of surviving on defoliated or dead leaves during winter. A pine native to the Islands is only *Pinus pumila*, and other pines, that are potentially capable of supporting infections and sporulations of *Coleosporium* species, have not been planted extensively. Therefore, only *Coleosporium saussureae* whose spermgonial-aecial stage is formed on *P. pumila*, can complete its life cycle and perpetuate in the Islands. *Coleosporium cimicifugatum* and *C. neocacaliae* are suspected to form their spermgonial-aecial stage on *P. pumila*, but this possibility has not yet been proven experimentally. *Pinus pumila* does not serve as a host for the other *Coleosporium* species found in the Islands. Accordingly, consistent occurrence of these *Coleosporium* species in a uredinial form annually in the Islands suggests that urediniospores formed on appropriate host(s) annually migrate by a long-distance wind dispersal either from the mainland of Hokkaido or from the maritime regions of the Continent. As discussed separately under each species in the list, distribution and persistence of *Cronartium kamtchaticum* and *C. ribicola* in the Islands may be interpreted by an annual long-distance wind dispersal.

Primary source of this wind dispersal of rust spores may be located in the west coast of Hokkaido. However, meteorological records of past ten years (Meteorological Report, Kishocho: 1981-1990) show that most frequent wind directions during late spring to fall (May to September) were SW to SSW in both Rishiri (observed at Kutsugata) and Rebun (observed at Funadomari) (Fig. 1) with average velocities ranging from 3 to 5 m/s. Wind directions of maximum velocities during the same period are SW or SSW (8-16 m/s) in the Rebun and SW, SSW or NNE (7-16 m/s) in the Rishiri (Fig. 2). The fact that tephra deposits, products of Mt. Rishirisan's eruption, are distributed directly eastward as a narrow belt in northern Hokkaido (Kobayashi, 1987) shows that westerly winds prevailed in late Pleistocene. This westerly wind direction seems to have prevailed throughout Holocene to the present time. This indicates that rust spores could not have been carried by wind directly from the west coast of Hokkaido to the Islands. This does not rule out a possibility, however, that rust spores are



transported by wind from various sites in Hokkaido and Honshu. But the spores are likely to be blown as well from the maritime region of the Continent northeastward to the Islands. Rust spores (in most cases urediniospores) released from host plants by air turbulence may be uplifted to several hundreds to a few thousand meters and transported to a place up to hundreds or even a few thousand kilometers distant from the original focus as known in *Puccinia graminis* f. sp. *tritici* in North America. Similarly the onset of outbreak of stripe rust (*Puccinia striiformis*) of wheat in Japan is often interpreted to be infection of the urediniospores transmitted from southeast of China. This kind of long-distance dispersal is certainly possible, though its frequency might be exceedingly low, and thus it has been one of major factors that influenced establishment and following modification of the rust flora of the Rishiri and the Rebun Islands.

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