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GEOGRAPHICAL DISTRIBUTION OF MICROCYCLIC SPECIES OF THE THREE RUST GENERA, PUCCINIA, UROMYCES AND PHRAGMIDIUM IN HOKKAIDO, JAPAN*

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ABSTRACT. Geographical data is presented for the microcyclic species of the rust genera, *Puccinia, Uromyces* and *Phragmidium* (Uredinales), that occur in Hokkaido, Japan. The distribution of these species in other parts of the Japanese Archipelago is tabulated, and the species are classified into six phytogeographical elements.

It is an interesting matter to compare the rust-flora in Hokkaido, northern district of Japan, with that of other districts in the world, and to consider their relationships. In this paper data on the geographical distribution of microcyclic species of the three rust genera, *Puccinia, Uromyces* and *Phragmidium* in Hokkaido, Japan is presented.

The following enumeration is a general list of the microcyclic species of the three genera of Uredinales in Hokkaido, northern district of Japan, based upon the data in a recent paper on the Uredinales of Hokkaido (Hiratsuka *et al.*, 1986).

The specimens of these rust fungi are now mostly preserved in the Hiratsuka Herbarium (Tokyo).

1. **Puccinia adenophorae** Dietel on *Adenophora remotiflora* & *A. triphylla* var. *japonica.*
2. **Puccinia adoxae** Hedwig f. on *Adoxa moschatellina.*
3. **Puccinia alpina** Fuckel on *Viola vaginata.*
4. **Puccinia anemones-raddeanae** S. Ito on *Anemone raddeana.*
5. **Puccinia arenariae** (Schum.) Winter on *Moehringia lateriflora, Spergula arvensis, Stellaria diversiflora* & *S. media.*
6. **Puccinia artemisiae-keiskeanae** Miura on *Artemisia keiskeana.*
7. **Puccinia asarina** Kunze on *Asarum heterotropoides.*
8. **Puccinia austroberingiana** (Savile) Savile on *Saxifraga fusca* var. *divaricata.*
9. **Puccinia campanulae** Carmich. in Berk. on *Campanula lasiocarpa.*
10. **Puccinia chrysosplenii** Grev. on *Chrysosplenium flagelliferum.*
11. **Puccinia circaeae** Pers. on *Circaea caulescens* var. *glabra* & *C. erubescens.*
12. **Puccinia cnici-oleracei** Pers. on *Achillea ptarmica* var. *macrocephala, Artemisia japonica, A. japonica* var. *macrocephala, A. montana, A. princeps, Cacalia hastata* subsp. *orientalis, Chrysanthemum parthenium, Ch. praealtum, Matricaria chamomilla* & *Sonchus brachyotus.*
13. **Puccinia conglomerata** (Strauss) Röhling on *Petasites japonicus* var. *giganteus.*
14. **Puccinia epilobii** DC. on *Epilobium hornemanni* var. *foucaudianum.*
15. **Puccinia exhausta** Dietel on *Clematis stans.*
16. **Puccinia fergussoni** Berk. & Broome on *Viola hirtipes* & *V. selkirkii.*
17. **Puccinia fusispora** P. & H. Sydow on *Urtica platyphylla.*
18. **Puccinia glechomatis** DC. on *Glechoma hederacea* var. *grandis.*
19. **Puccinia glomerata** Grev. on *Cacalia auriculata* var. *kamtschatica* & *Ligularia hodgsoni.*
20. **Puccinia hakkodensis** Hirats. f. on *Clintonia udensis.*

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21. **Puccinia haleniae** Arthur & Holway on *Halenia corniculata* & *Swertia tetrapetala*.
22a. **Puccinia heucherae** (Schw.) Dietel var. **japonica** Savile on *Saxifraga japonica*.
22b. **Puccinia heucherae** var. **minor** Savile on *Mitella nuda*.
23. **Puccinia horiana** Henn. on *Chrysanthemum morifolium* var. *sinense*.
24. **Puccinia lantanae** Farlow on *Justicia procumbens* var. *leucantha*.
25. **Puccinia majanthemi** Dietel on *Convallaria keiskei, Majanthemum bifolium, M. dilatatum, Polygonatum maximowiczii, Trillium kamtschaticum* & *T. tschonoskii*.
26. **Puccinia melanoplaca** P. & H. Sydow on *Patrinia gibbosa*.
27. **Puccinia ornata** Arthur & Holway on *Rumex obtusifolius*.
28. **Puccinia parkerae** Dietel & Holway on *Ribes japonicum* & *R. sachalinense*.
29. **Puccinia patriniae** Henn. on *Patrinia villosa*.
30. **Puccinia polemonii** Dietel & Holway on *Polemonium acutiflorum* var. *laxiflorum* & *P. yezoense*.
31. **Puccinia porphyrogenita** Curtis on *Chamaepericlimenum canadense*.
32. **Puccinia ribis** DC. on *Ribes latifolium* & *R. triste*.
33. **Puccinia saxifragae-micranthae** Barclay on *Saxifraga sachalinensis*.
34. **Puccinia schizonepetae** Tranzschel on *Nepeta subsessilis* var. *yezoensis*.
35. **Puccinia singularis** Magnus on *Anemone altaica*.
36. **Puccinia tiarellaecola** Hirats. f. on *Tiarella polyphylla*.
37. **Puccinia togashiana** Hirats. f. on *Thalictrum aquilegifolium* & *Th. thunbergii* var. *majus*.
38. **Puccinia tokubuchii** S. Ito on *Patrinia gibbosa*.
39. **Puccinia trollii** Karsten on *Trollius riederianus* var. *japonicus*.
40. **Puccinia umbilici** Guepin on *Rhodiola rosea* var. *tashiroi*.
41. **Puccinia ustalis** Berk. on *Trautvetteria japonica*.
42. **Puccinia veronicae** Schröter on *Veronica nipponica*.
43. **Puccinia veronicarum** DC. on *Veronicastrum sibiricum* var. *japonicum*.
44. **Puccinia vesiculosa** Schlechtendal on *Anemone narcissiflora*.
45. **Puccinia virgae-aureae** (DC.) Lib. on *Solidago virgae-aurea* & *S. virgae-aurea* subsp. *leiocarpa*.
46. **Puccinia waldsteiniae** Curtis on *Waldsteinia ternata*.
47. **Uromyces cacaliae** (DC.) Unger on *Cacalia auriculata* var. *bulbifera* & *C. auriculata* var. *kamtschatica*.
48. **Uromyces flectens** Lagerh. on *Trifolium repens*.
49. **Uromyces gageae** G. Beck on *Gagea lutea* & *Lloydia triflora*.
50. **Uromyces miurae** P. & H. Sydow on *Fritillaria camtschatcensis*.
51. **Uromyces peracarpae** S. Ito & Tochinai on *Percarpa circaeoides*.
52. **Uromyces rudbeckiae** Arthur & Holway on *Solidago virga-aurea* subsp. *asiatica*.
53. **Uromyces sommerfeltii** Hylander, Jørstad & Nannfeldt on *Solidago virga-aurea* subsp. *leiocarpa*.
54. **Phragmidium alpinum** Hirats. f. on *Rubus pedatus*.
55. **Phragmidium kamtschatkae** (F. W. Anderson) Arthur & Cummins on *Rosa rugosa*.
56. **Phragmidium miyabeanum** S. Ito & Hirats. f. on *Sieversia pentapetala*.

Distribution of species in the Japanese Archipelago

Table 1 presents the distribution of the microcyclic species of *Puccinia, Uromyces* and *Phragmidium* recorded from Hokkaido in relation to the other districts in the Japanese Archipelago.

Phytogeographical Classification

The 56 species (including two varieties) of microcyclic *Puccinia, Uromyces* and *Phragmidium* found in Hokkaido may be classified in the following six groups.

TABLE 1

	Japanese Archipelago: Japan								
	Sakhalin	Hokkaido	Northern Honshu	Central Honshu	Western Honshu	Shikoku	Kyushu	Ryukyu Islands	Formosa (Taiwan)
Puccinia adenophorae	+	+	+	+[m]	+[m]		+[m]		+[m]
P. adoxae		+							
P. alpina		+	+	+	+				
P. anemones-raddeanae	+	+							
P. arenariae	+	+	+	+	+	+	+		+[m]
P. artemisiae-keiskeanae		+	+	+	+	+			
P. asarina	+	+	+	+					
P. austroberingiana	+	+	+	+	+		+		
P. campanulae		+[m]	+[m]						
P. chrysosplenii	+	+		+	+	+	+		
P. circaeae	+	+	+	+					
P. cnici-oleracei	+	+	+	+	+	+	+	+	+
P. conglomerata	+	+	+						
P. epilobii		+[m]							
P. exhausta		+	+	+	+			+	+
P. fergussoni	+	+	+						
P. fusispora		+							
P. glechomatis		+	+	+	+	+	+	+	+
P. glomerata	+	+							
P. hakkodensis	+	+	+	+					
P. haleniae	+	+		+[m]					
P. heucherae var. japonica		+	+[m]						
P. heucherae var. minor		+							
P. horiana		+	+	+	+	+	+	+	
P. lantanae		+	+	+	+	+	+	+	+
P. majanthemi	+	+	+[m]	+[m]					
P. melanoplaca		+	+	+					
P. ornata		+							
P. parkerae	+	+	+	+		+[m]			
P. patriniae		+	+	+	+	+	+	+	+
P. polemonii	+	+[m]		+[m]					
P. porphyrogenita	+	+[m]	+[m]	+[m]					
P. ribis	+	+							
P. saxifragae-micranthae		+							
P. schizonepetae		+		+[m]		+[m]			
P. singularis		+							
P. tiarellaecola	+	+	+	+					
P. togashiana		+	+	+					
P. tokubuchii		+							
P. trollii		+							
P. umbilici		+[m]							
P. ustalis	+	+	+[m]	+[m]					+[m]
P. veronicae		+	+[m]						+[m]
P. veronicarum		+	+	+[m]					
P. vesiculosa	+	+[m]	+[m]	+[m]					
P. virgae-aureae	+	+[m]	+[m]	+[m]					
P. waldsteiniae	+	+		+					
Uromyces cacaliae	+	+							
U. flectens		+	+	+					
U. gageae		+							
U. miurae	+	+	+	+[m]					
U. peracarpae	+	+							
U. rudbeckiae	+	+	+	+	+	+	+		+
U. sommerfeltii	+	+[m]	+[m]	+[m]	+[m]				
Phragmidium alpinum	+[m]	+[m]		+[m]					
Ph. kamtschatkae	+	+							
Ph. miyabeanum	+[m]	+[m]	+[m]	+[m]					

+[m] denotes records confined to alpine or subalpine regions of high mountains.

1. Circumpolar elements

Puccinia adoxae
P. arenariae
P. asarina
P. campanulae
P. circaeae
P. conglomerata
P. epilobii
P. fergussoni
P. ribis
P. umbilici
P. ustalis
P. vesiculosa
P. virgae-aureae
Uromyces sommerfeltii

2. European and Eastern Asiatic elements

Puccinia alpina
P. chrysosplenii
P. glechomatis
P. glomerata
P. singularis
P. trollii
P. veronicae
P. veronicarum
Uromyces cacaliae
U. gageae
Phragmidium kamtschatkae

3. Elements of Himalaya, Continental China and Japan

Puccinia saxifragae-micranthae

4. North America and Eastern Asiatic elements

Puccinia austroberingiana
P. haleniae
P. heucherae var. *minor*
P. ornata
P. parkerae
P. polemonii
P. porphyrogenita
P. waldsteiniae
Uromyces miurae
U. rudbeckiae

5. Eastern Asiatic elements

a. Elements of Maritime Provinces of USSR and Japan

Puccinia anemones-raddeanae
P. hakkodensis
P. majanthemi
P. tiarellaecola
P. togashiana
Uromyces peracarpae
Phragmidium alpinum
Ph. miyabeanum

b. Elements of Continental China, Maritime Provinces of USSR and Japan

Puccinia fusispora
P. schizonepetae

c. Elements of Continental China, Taiwan (China), Korea and Japan

Puccinia adenophorae
P. artemisiae-keiskeanae
P. patriniae

d. Elements of Java, Philippines, Continental China, Korea, Maritime Provinces of USSR and Japan

Puccinia exhausta

e. Endemic elements:

i. Species peculiar to Hokkaido
Puccinia tokubuchii

ii. Species peculiar to Hokkaido and Honshu
Puccinia heucherae var. *japonica*
P. melanoplaca

6. Cosmopolitan elements

Puccinia cnici-oleracei
P. horiana
P. lantanae
Uromyces flectens

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