

**Aeciospore surface variation in *Puccinia recondita* and *P. coronata* species complexes**

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**List of specimens examined<sup>1</sup>**

1. *Aecidium hydnoideum* Berkeley & M. A. Curtis (formerly *Puccinia extensicola* Plowright var. *hydnoidea* (Berkeley & M. A. Curtis) Arthur) aeciospore type 1 on *Dirca palustris* L. (leatherwood, moosewood, wicopy; *Thymeleaceae*), Soderbeck Landing, St. Croix River ca. 5 miles west-northwest of Grantsburg, Burnett Co., WI, 30 June 1994, A. P. Roelfs & J. W. McCain 3229 (BPI-747570; PUR).
2. *Puccinia caricis-shepherdiae* J. J. Davis (*Aecidium allenii* G. W. Clinton) aeciospore type 1 on *Shepherdia argentea* (Pursh) Nuttall (silver buffaloberry; *Elaeagnaceae*), Sweetwater Lake, SD, 1928, J. F. Brenckle (MIN; Fungi Dakotenses 634);  
 -- type 1 on *S. canadensis* (L.) Nuttall (rabbitberry, soapberry), Bozeman, MT, 09 Aug. 1917, D. M. Sangohr (MIN ex MPPD; Herbarium J. R. Weir 8318); Eriksdale, Manitoba, 10 July 1939, W. J. Cherewick (MIN ex MPPD, from the Dominion Rust Research Laboratory).
3. *Puccinia coronata* Corda (*P. rhamni* (Persoon) Wettstein, *Dicaeoma rhamni* (Persoon) Kuntze, as (Wettstein) Kuntze) aeciospore type 1 on *Berchemia pauciflora* Maxim. (few-flowered supplejack; *Rhamnaceae*), Japan, Y. Ono 4735, 6595 (PUR ex Ibaraki University Herbarium 4735, 6595);  
 -- type 1 on *B. scandens* (J. Hill) K. Koch (Alabama supplejack, rattan-vine), Arkansas, 1993, G. E. Templeton (MIN ex MPPD);  
 -- types 1, 2 on *Frangula purshiana* (deCandolle) Cooper (Pursh's buckthorn, cascara sagrada; *Rhamnus purshiana* deCandolle, *Rhamnaceae*), South Westminster, Brit.

Columbia, 11 July 1922, *E. Bethel* (from telia on *Calamagrostis* sp.; MIN ex MPPD; Bartholomew's North American Uredinales no. 3066, issued as *P. rhamni*) – type 2; Spruce Cove, Trinidad, Humboldt Co., CA, June 1935, *H. E. Parks* 5538 (MIN-537835 ex UC Fungi of California) – type 1 (note: Savile, 1973, recorded this specimen as type 1-2); Clatskanie, OR, 29 May 1914, *F. D. Bailey* 1281 (MIN-313458, under *P. rhamni*; rust determined by H. S. Jackson) – type 1(-2?); Corvallis, OR, 09 May 1914, *H. S. Jackson* 1827 (MIN-313459, under *P. rhamni*) – type 1; Missoula, MT, 16 July 1917, *E. Bartholomew & J. R. Weir* (MIN-313457; Bartholomew's North American Uredinales no. 1864, as *P. rhamni*) – type 1;

-- types 1, 2 on *Rhamnus alnifolia* L'Her. (alder-leaved buckthorn; *Rhamnaceae*), Mineral Springs, IN, 09 May 1914, *L. M. Umbach* 6602 (MIN-843716 ex MIN-549845; rust determined by J. W. McCain) – type 2; Duluth, St. Louis Co., MN, 14 July 1923, *H. C. Gilbert* (MIN ex MPPD-227 under *Dicaeoma rhamni*; PUR) – type 1-2; Houston, Houston Co., MN, Aug. 1900, *H. L. Lyon* 546 (MIN-10666, under *P. rhamni*) – type 2; Lake Calhoun, Minneapolis, Hennepin Co., MN, May 1891, *E. P. Sheldon* 5969 (MIN-10665, under *P. rhamni*) – type 2; Ottertail Co., MN, 28 April 1904, *H. L. Lyon* (MIN-313476) – type 2; 1 mile north of Pennington, Beltrami Co., MN, 05 July 1979, *C. Keller* 62 (MIN-843719 ex MIN-715647; rust determined by J. W. McCain) – type 2; St. Paul, Ramsey Co., MN, 18 May 1899, *E. M. Freeman* 316 (MIN-10663, under *P. rhamni*) – type 2; Taft, MT, 20 June 1917, *J. R. Weir* 8236 (MIN-313477, under *P. rhamni*) – type 1?; Governor Knowles State Forest, Cedar bog interpretive trail at Norway Point, ca. 10 miles north of Grantsburg, Burnett Co., WI, 22 June 1995, *A. P. Roelfs, Anne R. Kubelik, & McCain* 3768 (BPI-747666; PUR) – type 2; Racine, Racine Co., WI, 14 June 1888, *J. J. Davis* (MIN-010668; Arthur et Holway Uredineae Exsiccati et Icones no. 31e, as *P. rhamni*) – type 2; Holland River marsh, Ontario, Canada, 11 June 1931, *A. J. V. Lehman* (MIN-612746 ex TRTC-2825; rust determined by H. S. Jackson) – type 2;

-- type 1 on *R. cathartica* L. (common or European buckthorn), Mississippi Palisades State Park, near Savannah, Carroll Co., IL, 23 May 1995, *A. P. Roelfs & J. W. McCain* 3441 (PUR); Wapsipinicon State Park, Anamosa, IA, 24 May 1995, *Roelfs & McCain* 3464 (PUR); Pilot Knob State Park east of Forest City, trail to overlook, elevation 1425 feet above sea level, Winnebago Co., IA, 25 May 1995, *Roelfs & McCain* 3557 (BPI-747667; PUR); Lake Johanna County Park, Arden Hills, Ramsey Co., MN, 16 June 1995, *McCain* 3690 (PUR); Cold Spring, Stearns Co., MN, 08 June 1995, *Roelfs* (PUR); Dellwood, Minn., 21 June 1992, *McCain* 2634 (PUR); Eden Prairie, along roadside opposite Flying Cloud Airport, Hennepin Co., MN, 26 May 1995, *Roelfs & McCain* 3603 (PUR); rest park along Interstate Highway 35, ca. 1.5 miles south of Elko exit, Scott Co., MN, 26 May 1992, *McCain* 2556 (PUR); city park Pipestone, Pipestone Co., MN, 03 June 1994, *Roelfs* (PUR); Hay Creek Recreation Area south of Red Wing, Goodhue Co., MN, 03 June 1992, *Roelfs, McCain* 2600, et al. (PUR); Upper Plum Creek County Park, 1 mile south, 1 mile west of Walnut Grove, Redwood Co., MN, 01 July 1995, *McCain* 3823 (PUR); Crosby, ND, 19 June 1924, *A. L. Truax* (MIN ex MPPD; Brenckle's Fungi Dakotenses no. 660); Hudson, WI, 1990, *E. L. Stewart* (PUR);

-- type 1 on *R. japonica* Maxim. var. *decipiens* Maxim. (Japanese buckthorn), Okami, Satomi-mura, Kuji-gun, Ibaraki Prefecture, Japan, 09 June 1990, *Y. Ono* 2118 (PUR ex Ibaraki Univ. herbarium no. 4810);

-- type 1 on *R. lanceolata* Pursh (probably var. *glabrata* Gleason; lance-leaved buckthorn; note: not "lame-leaved" [sic] as in Farr et al., 1989), Lafayette, Tippecanoe Co., IN, 12 May 1898, *J. C. Arthur* (MIN-10669; Arthur ex Holway Uredineae Exsiccati et Icones no. 31d, as *P. rhamni*); Weeping Water, NE, 18 June 1898, *M. A. Carleton* (MIN ex MPPD ex BPI);

-- type 1 on *Shepherdia canadensis*, Camp Roosevelt, WY, 1924, *H. S. Conard 1787* (MIN-327654 ex BPI-4596); Glacier National Park, MT, 1923, *Edith K. Cash* (MIN ex BPI).

4. *Puccinia dioicae* P. Magnus (species complex) aeciospore type 5 on *Solidago canadensis* L. (Canada goldenrod, *Asteraceae*), Dunn Co., WI, 1994, *W. R. Bushnell & Y. Anikster 58a* (PUR).

5. *Puccinia graminis* Persoon aeciospore type 4 on *Berberis vulgaris* L. (common barberry, *Berberidaceae*), Minnesota, *H. C. Gilbert 9* (MIN ex MPPD).

6. *Puccinia recondita* Desmazieres (*Dicaeoma clematidis* (Lagerheim) Arthur, *P. agropyri* Ellis & Everhart, *P. agropyrina* Eriksson, *P. alternans* Arthur, *P. apocrypta* Ellis & Tracy, *P. clematidis* Lagerheim, *P. dispersa* Eriksson & E. Henning, *P. impatientis* Arthur (later homonym of *P. impatientis* Schub. = *P. argentata*), *P. impatienti-elymi* Arthur, *P. persistens* Plowright, *P. rubigo-vera* (deCandolle) G. Winter, *P. rubigo-vera* var. *agropyri* (Eriksson) Arthur, *P. rubigo-vera* var. *agropyrina* (Eriksson) Arthur, *P. rubigo-vera* var. *impatientis* (Arthur) Mains (invalid combination); anamorphs *Aecidium actaeae* Wallroth, *A. cimicifugatum* M. A. Curtis, *A. clematidis* deCandolle, *A. delphinii* Bartholomew, *A. hydrophylli* Peck, *A. onosmodii* Arthur, *A. phaceliae* Peck, *A. ranunculacearum* deCandolle in part, *A. thalictri* Greville, *A. thalictri-flavi* (deCandolle) G. Winter not Sydow; incorrect synonyms *P. montanensis* Ellis, *P. tomipara* Trelease, *Aecidium anemones* Persoon [= *Ochropsora ariae*])

-- aeciospore type 3 on *Impatiens capensis* Meerb. (orange or spotted touch-me-not or jewelweed, lady's-earrings, kicking-colt; *I. biflora* Walt., *I. fulva* Nuttall, *Balsaminaceae*), West Lafayette, Tippecanoe Co., IN, 22 May 1916, *H. S. Jackson* (MIN-313449, under *P. impatientis*); Louisville, Pottawatomie Co., KS, 23 May 1900, *E. Bartholomew* (MIN-612575; Bartholomew's North American Uredinales no. 2803, issued as on *I. fulva*); Afton State Park south of Afton, Washington Co., MN, 03 June 1992, *A. P. Roelfs, J. W. McCain 2569, et al.* (PUR); Glenwood, Pope Co., MN, July 1891, *B. C. Taylor 826* (MIN-7441, under *Aecidium impatientis*); Mille Lacs Indian Reservation, Mille Lacs Co., MN, June 1892, *E. P. Sheldon 2495* (MIN-7437, under *A. impatientis*); Turtle Lake, LeSeuer Co., MN, 12 June 1891, *Sheldon 219* (MIN-7438, under *A. impatientis*); Queen's Bluff near Winona, Winona Co., MN, 19 June 1899, *J. M. Holzinger* (MIN-7440, under *A. impatientis* on *I. fulva*); Willow Lake, ca. 5 miles east of Willow River, Pine Co., MN, 29 June 1995, *J. V. Groth & McCain 3815* (PUR); Long Pine, NE, 27 June 1899, *Rev. J. M. Bates* (PUR-25633); Valentine, NE, 10 Aug. 1911, *Bates* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 3558, as *P. impatientis*); Arkville, Delaware Co., NY, 27 July 1915, *P. Wilson* (MIN-411558; Wilson's Fungi found within 100 miles of New York City no. 125, as *P. impatientis*); New York Botanical Gardens, Bronx, Bronx Co., N.Y., 20 June 1916, *Wilson* (MIN-411917;

Wilson's Fungi found, no. 297, as *P. impatientis*); Lyndonville, NY, 16 July 1913, *E. Bartholomew & Fairman* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 4150); Taughannock, NY, 10 July 1907, *H. H. Whetzel & M. P. Barrus* (MIN-612563 ex CUP-2526 as *P. impatientis* on *I. fulva* [sic]); Ohio State University campus, Columbus, Franklin Co., OH, 21 May 1891, *M. Craig 2749* (MIN ex MPPD-105, under *A. impatientis* on *I. fulva*); Granville, Licking Co., OH, 17 June 1910, *E. Bartholomew* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 3357 as *P. impatientis*); Phillipsburg, PA, 05 July 1925, *L. W. Nuttall* (MIN ex MPPD; Bartholomew's North American Uredinales no. 3466 as *P. impatientis*); Memory Lake city park, Grantsburg, Burnett Co., WI, 23 June 1994, *Roelfs & Y. Anikster 72a* (MIN ex MPPD); County Road 'O' access site of St. Croix National River, 10 miles southwest of Grantsburg, 22 June 1995, *Roelfs, Anne R. Kubelik, & McCain 3754* (PUR); Governor Knowles State Forest, cedar bog interpretive trail at Norway Point, ca. 10 miles north of Grantsburg, 22 June 1995, *Roelfs, Kubelik, & McCain 3763* (PUR); Governor Knowles State Forest, Old Paint Mine Trail, ca. 5 miles northwest of Grantsburg, June 1996, *Roelfs & McCain 4207* (BPI-747717; PUR);

-- type 3 on *I. pallida* Nuttall (pale touch-me-not, yellow jewelweed; *I. aurea* Muhl), Purdue University Horticulture Park, West Lafayette, Tippecanoe Co., IN, 21 June 1978, *J. W. McCain 1305* (PUR); Decorah, Winneshiek Co., IA 07 June 1903, *E. W. D. Holway* (MIN-612569); same, 28 June 1886, *Holway* (MIN-313455; Bartholomew's North American Uredinales no. 852 as *P. impatientis* on *I. aurea*); Topeka, KS, 12 May 1908, *E. Bartholomew & H. W. Baker* (apparently from telia on *Elymus virginicus*; MIN-313456; Bartholomew's Fungi Columbiani no. 2666 as *P. impatientis* on *I. aurea*); Ninemile Creek, Bloomington, Hennepin Co., MN, 26 May 1939, *E. Andrews* (MIN ex MPPD-40377, under *P. rubigo-vera impatientis*); Louisiana, MO, 22 June 1925, *E. Bartholomew* (MIN ex MPPD; Bartholomew's North American Uredinales no. 3354 as *P. impatientis* on *I. aurea*); Arkville, Delaware Co., NY, 24 July 1915, *P. Wilson* (MIN-411480; Wilson's Fungi found within 100 miles of New York City no. 115, as *P. impatientis*); Ithaca, NY, 30 June 1911, *B. B. Higgins* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 3557 as *P. impatientis* on *I. aurea*); Fargo, ND, May 1909, *H. F. Bergman* (MIN ex MPPD; Brenckle's Fungi Dakotenses no. 543 as *P. impatientis*); glen below Cascade Falls, Osceola, Polk Co., WI, 26 June 1996, *McCain 4213* (PUR); London, Ontario, Canada, May-June 1911, *J. Dearness* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 4060 as *P. impatientis*);

-- type 3 on *I. sp.*, Tecumseh Trails Rest Park on State Road 43, north of West Lafayette, Tippecanoe Co., IN, 12 June 1993, *J. W. McCain 2890* (PUR); College Park, MD, 1950, *F. Petrak* (MIN-819027, Reliquiae Petrakiense 1742 as *P. impatientis*); Afton State Park south of Afton, Washington Co., MN, 07 June 1995, *A. P. Roelfs, McCain 3610, et al.* (PUR); Annandale, MN, 1900, *E. M. Freeman 686* (MIN-7435); Battle Creek Park, Saint Paul, Ramsey Co., MN, 16 July 1995, *McCain 3839* (MIN); Crosby Farms Park, Saint Paul, 13 June 1996, *McCain 4175* (PUR); Curtain Falls Trail, Interstate State Park, ca. 1 mile south of Taylors Falls, Chisago Co., MN, 19 June 1996, *McCain 4184* (PUR); Laura Ingalls Wilder dugout home site on Plum Creek, 1.5 miles north of Walnut Grove, Redwood Co., MN, 01 July 1995, *McCain 3821* (BPI-747720, PUR); roadside ca. 2 miles south of Welch, Goodhue Co., MN, 03 June 1992, *Roelfs, McCain 2586, et al.* (PUR); same, 14 June 1996, *J. V. Groth & McCain 4182* (BPI-747719, PUR); Merilla,

WV, 1904, *Sheldon 653* (MIN-313437, under *P. impatientis*); Cascade Falls, Osceola, Polk Co., WI, 05 July 1992, *McCain 2654* (PUR); Holland River marsh, Ontario, Canada, 1936, *R. F. Cain* (MIN-612565, under *P. impatientis*);

--aeciospore type 2 on *Anchusa arvensis* (L.) Bieb. (small bugloss; *Lycopsis arvensis* L., *Boraginaceae*), Skive, Denmark, 1902, *Lind* (MIN ex MPPD, under *P. dispersa*); Israel, 1996, produced by culture from telia on rye collected in Poland, comm. Y. Anikster;

-- type 2 on *A. azurea* P. Mill. (Italian bugloss; *A. italica* Retz), 1996, produced by culture in Israel from telia on durum wheat collected in Morocco, comm. Y. Anikster;

-- type 2 on *Lithospermum canescens* (Michaux) Lehm. (hoary puccoon), Kulm, ND, 1922, *J. F. Brenckle* (MIN);

-- type 2 on *L. incisum* Lehm. (narrow-leaved puccoon; *L. angustifolium* Michaux, *L. linearifolium* Goldie, *Boraginaceae*), near Kulm, Lamoure Co., ND, June 1914, *J. F. Brenckle* (MIN ex MPPD; BPI-099883 as *P. rubigo-vera apocrypta* (annotated by G. B. Cummins); Brenckle's Fungi Dakotenses no. 367a, as *P. montanensis*!); same, 09 June 1922, *Brenckle* (MIN ex MPPD; BPI-099887; Brenckle's Fungi Dakotenses no. 516a as *P. apocrypta*);

-- type 2 on *Onosmodium molle* Michaux var. *occidentale* (Mackenzie) I. M. Johnston (marbleseed, western false gromwell; I), Denver, CO, 27 June 1924, *E. Bethel* (MIN ex MPPD; BPI-099905; Bartholomew's North American Uredinales no. 3127 as *P. apocrypta*); Stockton, KS, 1904, *E. Bartholomew* (MIN ex MPPD, under *A. onosmodii*); Callaway, NE, 1902, *J. M. Bates* (MIN ex MPPD); Red Cloud, NE, 26 May 1911, *Bates* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 3401; BPI-099899 as *P. rubigo-vera apocrypta*); Kulm, Lamoure Co., ND, 19 June 1915, *J. F. Brenckle 907* (MIN-315245; MIN ex MPPD – Brenckle's Fungi Dakotenses no. 343, as *P. montanensis*!; BPI-099903);

-- aeciospores types 1, 2 on *Ellisia nyctelea* (L.) L. (water-pod; *Macrocalyx nyctelea* (L.) Kuntze, *Hydrophyllaceae*), Clyde, KS, 22 May 1923, *E. Bartholomew* (MIN ex MPPD; BPI-099891; Bartholomew's North American Uredinales no. 2928 as *P.*

*apocrypta* on *Macrocalyx nyctelea*) – type 2; Deep Creek Road, ca. 7 miles southeast of Manhattan, Riley Co., KS, 23 May 1961, *C. L. Kramer* (MIN-612764 ex Kansas St. Univ. herbarium no. 330) – type 1; 12.5 miles W and 2.75 miles north of Winonia, Wallace Co., KS, 10 June 1959, *Kramer* (MIN-612763 ex Kansas St. Univ. herbarium no. 304) – type 1?; Rooks Co., KS, 1900, *E. Bartholomew* (BPI-067079) – type 2; Nelson, NE, 06 June 1913, *J. M. Bates* (MIN ex MPPD; BPI-099152; Bartholomew's Fungi Columbiani no. 4101 as *Macrocalyx nyctelea*) – type 2;

-- type 3 on *Hydrophyllum capitatum* Benth. (cat's-breeches, ballhead waterleaf; *Hydrophyllaceae*), Klickitat Co., WA, 11 May 1894, *W. N. Suksdorf 379* (MIN-612769, BPI-152301);

-- type 3 on *H. fendleri* (A. Gray) A. Heller (Fendler's waterleaf), Palmer Lake, CO, 28 June 1925, *E. Bethel* (MIN ex MPPD, BPI-099864; Bartholomew's North American Uredinales no. 3335 as *P. apocrypta*);

-- type 3 on *H. occidentale* (S. Wats.) A. Gray (California waterleaf, including var. *watsoni* Gray), Grouse Mountain..., CA, 1935, *J. P. Tracy 14081* (MIN-548256); Red

- Butte Canyon, UT, 26 June 1915, *E. Bartholomew & A. O. Garrett* (MIN-315195; Bartholomew's Fungi Columbiani 4839 as *P. agropyri* on *H. occidentale* var. *watsoni*; BPI-099124);
- type 3 on *H. tenuipes* Heller (Pacific waterleaf), Sol Duc Hot Springs, WA, 1920, *J. R. Weir* (MIN-327712 ex BPI-60767, under *Aecidium phaceliae*); near Fairfax, Pierce Co., WA, 17 June 1930, *H. E. Parks & S. T. Parks* (MIN-327711, BPI-099872; UC California Fungi no. 9, as *A. phaceliae*);
  - type 3 on *H. virginianum* L. var. *virginianum* (Virginia waterleaf, Shawnee salad), Annandale, Wright Co., MN, 1900, *E. M. Freeman* 600 (MIN-7416, under *Aecidium hydrophylli*); northern Hennepin Co., MN, 1968, *J. V. Groth* (MIN ex MPPD-40376); Mille Lacs Lake, Mille Lacs Co., MN, 1891, *E. P. Sheldon* 2822 (MIN-7418, under *A. phaceliae*); St. Paul, Ramsey Co., MN, 1899, *Freeman* 397 (MIN-7417, under *A. phaceliae*); Interstate State Falls, behind ranger's office at picnic area, ca. 1 mile south of Taylors Falls, Chisago Co., MN, 18 June 1995, *J. W. McCain* 3704 (PUR); wooded hillside ca. 2 miles south of Welch along Co. Road 7, Goodhue Co., MN, 22 May 1991, *A. P. Roelfs, McCain* 2358, et al. (MIN ex MPPD-40355, PUR); same, 07 June 1995, *Roelfs, McCain* 3629, et al. (BPI-747715, PUR); Fargo, ND, 1915, *O. A. Stevens* (MIN ex MPPD; Brenckle Fungi Dakotenses no. 302);
  - type 1 on *Nemophila parviflora* Benth. (woods or small-flowered nemophila; *Hydrophyllaceae*), Skamania Co., WA, 1894, *W. N. Suksdorf* 378 (MIN-315202, under *Aecidium phaceliae*; BPI-152788);
  - type 1 on *Phacelia hastata* Lehm. (silverleaf phacelia; *P. leucophylla* Torr., *Hydrophyllaceae*), Yellowstone National Park, WY, 1924, *E. Bartholomew* (MIN ex MPPD; Bartholomew North American Uredinales no. 3225, as *P. apocrypta*);
  - type 1 on *P. imbricata* Greene (imbricate phacelia), Darlingtonia, Del Monte Co., CA, 1939, *H. E. Parks* 6394 (MIN-669613, as *Puccinia rubigo-vera apocrypta* on *Phacelia californica* Cham. var. *imbricata*; BPI-099369);
  - type 1 on *P. ramosissima* Lehm. (branching phacelia), Monterey Bay, CA, 1909, *W. T. Swingle* (MIN ex MPPD; Bartholomew North American Uredinales no. 3225, as *P. apocrypta*);
  - type 1 on *P.* sp. (issued as *P. circinata* (Willd.) Jacq. [= *P. secunda* J. F. Gmelin ?]), Skamania, WA, 1895, *W. N. Suksdorf* 458 (MIN-315217, under *Aecidium phaceliae*);
- aeciospore type 1 on *Actaea rubra* (Aiton) Willd. (red baneberry; *Ranunculaceae*), Madison Lake, MN, 1891, *E. P. Sheldon* 392 (MIN-7018, under *Aecidium actaeae*; host originally identified as *A. alba* [auct. non] L., in error); Curtain Falls Trail, Interstate State Park, ca. 1 mile south of Taylors Falls, Chisago Co., MN, 19 June 1996, *J. W. McCain* 4186 (PUR); Governor Knowles State Forest, Old Paint Mine Trail, ca. 5 miles northwest of Grantsburg, Burnett Co., WI, 22 June 1995, *A. P. Roelfs, McCain* 3710, et al. (PUR; no rust on adjacent plant of *A. pachypoda*, white baneberry); St. Croix National River, Soderbeck Landing (canoe access site), west end of Ferry Road, ca. 5 miles west-northwest of Grantsburg, 22 June 1995, *Roelfs, McCain* 3774c, et al. (PUR);
- type 1 on *A.* sp., Decorah, Winneshiek Co., IA, 1899, *E. W. D. Holway* 2537 (MIN-613036); Glenwood, MN, 1891, *B. C. Taylor* 889 (MIN-7224); Litchfield, MN, 1927, *A. H. Larson* (MIN ex MPPD-3767, under *P. clematidis*); Pine Co., MN, 1974, *J. V. Groth* (MIN ex MPPD);

-- type 1 on *Anemone canadensis* L. (meadow or Canada anemone; *Ranunculaceae*), Spirit Lake, IA, 1900, *J. C. Arthur* (PUR); Black Dog Natural Area, north of Cliff Road, Burnsville, Dakota Co., MN, 03 June 1994, *J. W. McCain 3181* (PUR); St. Paul, Ramsey Co., MN, 1899, *E. M. Freeman* (MIN-7664, under *Aecidium ranunculacearum*); Winona, Winona Co., MN, 1889, *J. M. Holzinger* (MIN-7668, under *Aec. ranunculacearum*); Winnipeg, Manitoba, 1938, *Dominion Rust Research Laboratory* (MIN ex MPPD, under *P. agropyrina*);

-- type 1 on *A. cylindrica* A. Gray (candle anemone, long-headed thimbleweed; *Ranunculaceae*), Decorah, Winneshiek Co., IA, 1902, *E. W. D. Holway* (MIN-613031); Scotia, NE, 17 June 1910, *J. M. Bates* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 3303);

-- type 1 on *A. quinquefolia* L. var. *bifolia* Farw. (twoleaf wood anemone), Decorah, Winneshiek Co., IA, 1888, *E. W. D. Holway* (MIN ex MPPD-7665, under *Anemone nemerosa*); Mille Lacs, Mille Lacs Co., MN, 1892, *E. P. Sheldon 2566* (MIN-7670, under *Aecidium ranunculacearum*); Nichols, MN, 1891, *Sheldon 2312* (MIN-7665, two specimens); northern Pine Co., MN, 1988, *J. V. Groth* (PUR); Pine Co., 1991, *Groth* (MIN); woods, 3 miles east of Willow River, T. 44N, R. 19W, Sect. 4, 29 June 1995, *Groth & J. W. McCain 3794* (PUR); Fish Lake Wildlife Refuge, firebreak along Stolte Road, ca. 3 miles southwest of Grantsburg, Burnett Co., WI, 16 June 1993, *A. P. Roelfs 93Wi9008, McCain 2941, et al.* (BPI-747711, PUR); Governor Knowles State Forest, Brandt Pines ski trail, northwest of Grantsburg, WI, 22 June 1995, *Roelfs, McCain 3775a, et al.* (BPI-747709, PUR);

-- type 1 on *A. virginiana* L. (tall thimbleweed), Hubbard Co., MN, 1958, *J. McAndrews 241* \_ (PUR); Minneapolis, Hennepin Co., MN, 1914, *E. Bartholomew & E. W. D. Holway* (MIN ex MPPD-1399, as *Aecidium anemones*);

-- type 1 on *A. sp.*, Curtain Falls Trail, Interstate State Park, ca. 1 mile south of Taylors Falls, Chisago Co., MN, 07 Sept 1995, *J. W. McCain 3854b* (PUR; telia of *Puccinia anemones-virginianae* also present on specimen); Grantsburg, WI, 1995, *A. P. Roelfs*; Thunder Bay, Ontario, 1913, *R. F. Cain* (MIN-613026 ex TRTC-40233);

-- type 1 on *Aquilegia flavescens* S. Wats. (golden columbine; *Ranunculaceae*), Alpine, MT, elevation 10,000 feet, 05 Aug 1921, *E. Bartholomew* (MIN ex MPPD; Bartholomew's North American Uredinales no. 2744, as *P. clematidis*); Glacier National Park, MT, 1940, *H. Bailey & Virginia Bailey* (MIN-669668 ex MPPD ex UC, as *P. rubigo-vera agropyri*); Yellowstone National Park, WY, 05 July 1925, *E. Bartholomew & Mrs. E. Bartholomew* (MIN ex MPPD; Bartholomew North American Uredinales no. 3135, as *P. clematidis*); Banff, Alberta, Canada, 25 July 1901, *E. W. D. Holway* (MIN-310814);

-- type 1 on *A. formosa* deCandolle (western or crimson columbine), Glacier, Brit. Columbia, Canada, 1918, *E. W. D. Holway* (MIN-613025);

-- type 1 on *A. formosa* var. *truncata* (Fisch. & C. A. Mey.) Baker (western columbine), Monumental, del Norte Co., CA, 1936, *H. E. Parks & J. P. Tracy* (MIN-537737; Bartholomew's North American Uredinales no. 1929, as *P. clematidis*); Mill Valley, CA, 1918, *E. Bethel* (MIN ex UC California Fungi no. 1087);

-- type 1 on *A. sp.*, Boranza, ID, 08 Aug 1911, *W. H. Long* (MIN-310802);

-- type 1 on *Cimicifuga acerina* (Sieb. & Zuccarini) Tanaka (compact bugbane; *Ranunculaceae*), Japan, *Y. Ono 6501* (PUR);

- type 1 (and 4?) on *C. japonica* (Thunb.) Sprengel (Japanese bugbane; var. *obtusiloba*?), Tsukuba, Japan, 1983, *Y. Ono* 2762 (PUR);
- type 1 on *C. racemosa* (L.) Nuttall (black snakeroot), Montgomery Co., MD, 1903, *C. F. Wheeler* (MIN ex MPPD, under *Aecidium cimicifugatum*);
- type 4 on *C. simplex* deCandolle (Kamchatka bugbane), Nagano, Japan, 1981, *Y. Ono* 2223 (PUR);
- type 3 on *Clematis drummondii* Torrey & A. Gray (Drummond's clematis), Wichita Falls, TX, 09 May 1928, *E. Bartholomew* (MIN ex MPPD; Bartholomew's North American Uredinales no. 3340);
- type 1 on *C. hirsutissima* Pursh (hairy clematis; *C. douglasii* Hook., *Ranunculaceae*), Genessee Mountain, Colo., 1916, *E. Bethel* (MIN); Helena, MT, 1889, *F. D. Kelsey* (MIN-613011);
- type 1 on *C. lasiantha* Nuttall (pipestem clematis), Berkeley, CA, April 1893, *W. C. Blasdale* (MIN-310950; Bartholomew's North American Uredinales no. 1229); Missoula, MT, 1916, *J. R. Weir* 2615 (MIN ex MPPD, under *P. clematidis*);
- type 1 on *C. ligusticifolia* Nuttall (western clematis), Hornbrook, Siskiyou Co., CA, 1903, *E. B. Copeland* (MIN-310955, under *P. agropyri*); Colorado Springs, CO, 1893, *D. Saunders* (MIN ex MPPD, under *P. rubigo-vera agropyri*); Morrison, CO, 1902, *E. Bartholomew* (MIN-310973; Sydow Uredineen no. 1709, as *P. agropyri*); Castleford, ID, 1912, *A. Nelson & J. F. Macbride* (MIN-310949, under *P. agropyri*); Lewiston, Nez Perce Co., ID, 1896, *A. A. Heller* 80 (MIN ex MPPD, under *Aecidium clematidis*); Missoula, MT, 1917, *E. Bartholomew & J. R. Weir* (MIN-310971, under *P. agropyri*); Sand Coulee, MT, 1888, *F. W. Anderson* (MIN-613012); Fresno, NM, 1899, *E. O. Wooton* (MIN-310974 ex US); Clear Creek Canyon, Sevier Co., UT, 1909, *A. O. Garrett* (MIN-310953; Fungi Utahenses no. 182, as *P. agropyri*); Wenatchee, WA, 1912, *E. Bartholomew* (MIN ex MPPD; Bartholomew's Fungi Columbiani no. 4457, as *P. clematidis*); Thermopolis, WY, 1924, *E. Bartholomew* (MIN ex MPPD; Bartholomew's North American Uredinales no. 3137, as *P. clematidis*); Pecos, Mexico, 1903, *T. D. A. Cockerell* (MIN ex MPPD, under *P. agropyri*);
- type 1 on *C. occidentalis* (Hornem.) deCandolle (western blue virgin's-bower; *C. verticillaris* deCandolle), Batchawana Bay north of Sault Ste. Marie, Ontario, Canada, 1935, *R. E. Fitzpatrick* (MIN-613016);
- type 1 on *C. terniflora* deCandolle (yam-leaved clematis) Japan, *Y. Ono* 3223 (PUR); Mount Nantaisan, Ibaraki, Japan, 1990, *Y. Ono* 2045 (PUR);
- types 1 and 3 on *C. virginiana* L. (virgin's bower), Monitor, Tippecanoe Co., IN, 1931, *R. M. Caldwell* (PUR) – type 1; Decorah, Winneshiek Co., IA, 1885, *E. W. D. Holway* (BPI-067166) – type 1; Glenwood, MN, 1892, *C. MacMillan* 6 (MIN-7250, as *Aecidium clematidis*) – type 1; north shore of Willow Lake, ca. 5 miles east of Willow River, Pine Co., MN, 29 June 1995, *J. V. Groth & J. W. McCain* 3813 (PUR; no rust on *Anemone canadensis*, *Actaea rubra*, or *Thalictrum dasycarpum* at this site; only scant rust on *Anemone quinquefolia*, *Impatiens biflora*) – type 1; Decorah, IA, 1899, *Holway* (MIN-613015) – type 3; same, 1901, *Holway* (MIN-613017) – type 3; Houston, Houston Co., MN, 1899, *H. L. Lyon* 106 (MIN-7251, under *Aecidium clematidis*) – type 3; Milaca, MN, 1892, *E. P. Sheldon* 2764 (MIN-7247, under *A. clematidis*) – type 3; Sleepy Eye, MN, 1891, *Sheldon* 907 (MIN-7249, under *A. clematidis*) – type 3; roadside along Co. Road 7, ca. 2 miles south of Welch, Goodhue Co., MN, 02 July 1992, *A. P. Roelfs*,



- McCain 2637, et al. (BPI-747713, PUR) – type 3; same, 03 June 1992, Roelfs, McCain 2589, et al. (PUR) – type 3; Long Pine, NE, 1899, J. M. Bates (PUR-88317) – type 3; Arkville, NY, 1915, P. Wilson 109, stem galls (MIN-411495) – type 3; same, Wilson 99, on leaves (MIN-411496) – type 3; Ithaca, NY, 1916, H. S. Jackson & L. Hesler (MIN-613018) – type 3; Johnson, VT, 1893, A. J. Grout (MIN ex MPPD; Reliquiae Seymourianae) – type 3; Four-mile House, WI, 1887, L. H. Pammel (MIN ex MPPD, under *P. agropyri*) – type 3; St. Croix National River, County Road ‘O’ canoe landing, ca. 10 miles southwest of Grantsburg, Burnett Co., WI, 22 June 1995, Roelfs, Anne R. Kubelik, & McCain 3755 (PUR) – type 3;
- type 1 on *C. sp.*, Duluth, MN, 1927, H. C. Gilbert 212 (MIN ex MPPD, under *Dicaeoma clematidis*; PUR); Orin, WY, 1919, W. L. Hess (MIN ex MPPD, under *P. clematidis*);
    - type 1 on *Delphinium bicolor* Nuttall (little larkspur), Sand Coulee, MT, 1888, F. W. Anderson (MIN-613008); Greycliff, MT, 1913, C. D. Marsh (MIN ex MPPD, under *Aecidium delphinii*); Wind Cave National Park, SD, 1927, J. F. Brenckle & O. A. Stevens (MIN ex MPPD; Brenckle’s Fungi Dakotenses no. 604, as *Dicaeoma clematidis*);
    - type 1 on *D. carolinianum* Walt. subsp. *virescens* (Nuttall) Brooks (Carolina larkspur; *D. albescens* Rydberg, *Ranunculaceae*), Red Cloud, NE, 1903, J. M. Bates (MIN-613007);
    - type 1 on *D. geyeri* Greene (Geyer's larkspur), Boulder, CO, 1924, E. Bethel (MIN ex MPPD; Bartholomew’s North American Uredinales no. 3136, as *P. clematidis*);
    - type 1 on *D. robustum* Rydberg (Wahatoya Creek larkspur), Manitou, CO, 1916, J. M. Bates (MIN-310824, under *P. agropyri*);
    - type 1 on *D. trollifolium* A. Gray (Columbian or poison larkspur), Buck Mountain, Humboldt Co., CA, 1950, J. P. Tracy 18884 (MIN-548255, as *P. agropyri*; NOTE: spores longer and narrower than in most specimens);
    - type 1 on *Enemion biternatum* Raf. (*Isopyrum biternatum* (Raf.) Torrey & A. Gray, eastern false rue-anemone; *Ranunculaceae*), Decorah, Winneshiek Co., IA, 1886, E. W. D. Holway (MIN ex MPPD; Rabenhorst-Winter-Pazschke Fungi Europaei et extraeuropaei no. 3836); Rice Co., MN, 1968, J. V. Groth (MIN ex MPPD-40380);
    - type 1 on *Ranunculus abortivus* L. (small-flowered buttercup; *Ranunculaceae*), Annandale, Wright Co., MN, 1899, E. M. Freeman 637 \_ (MIN-7666, under *Aecidium ranunculacearum*); Vermilion Lake, northern St. Louis Co., MN, 1886, J. C. Arthur, E. W. D. Holway 312H, & L. H. Bailey, Jr. (MIN-7767, under *A. ranunculacearum*);
    - type 1 on *R. glaberrimus* Hook. (sagebrush buttercup), Pullman, WA, 1894, C. V. Piper 257 (PUR, under *Aecidium ranunculacearum*);
    - type 1 on *R. hebecarpus* Hook. & Arnott (delicate buttercup), Klickitat Co., WA, 1893, W. N. Suksdorf (MIN-311107, under *P. agropyri*);
    - type 1 on *R. occidentalis* Nuttall (western buttercup), Klickitat Co., WA, 1894, W. N. Suksdorf (MIN-311084, under *P. agropyri*);
    - type 1 on *Thalictrum aquilegifolium* L. (columbine meadow-rue; including var. *intermedium*, *Ranunculaceae*), Nagano, Japan, 1981, Y. Ono 677 (PUR);
    - type 1 on *T. dasycarpum* Fischer & Ave-Lall. (purple meadow-rue, *T. purpurascens* auct. non L.), Riley Co., KS, 1958, C. L. Kramer (MIN-612991); Brownsdale, MN, 1919, J. J. Christensen (MIN ex MPPD-3551, under *P. persistens*); Purgatory Swamp, Deephaven, Hennepin Co., MN, 1916, E. C. Stakman & E. Louise

*Jensen* (MIN ex MPPD-1863, under *P. persistens*); same, 1922, *H. C. Gilbert* (MIN ex MPPD-3505, under *P. persistens*); Fort Snelling, MN, 1922, *Gilbert* (MIN ex MPPD-3442, under *P. clematidis*); St. Paul, Ramsey Co., MN, 1899, *E. M. Freeman* 318 (MIN-7746, under *Aecidium thalictri-flavi* on *T. purpurascens*); Turtle Lake (Ramsey Co. or ?), MN, 1916, *Freeman* (MIN ex MPPD-1917, as *P. persistens*); Vermilion Lake, northern St. Louis Co., MN, 1886, *J. C. Arthur, E. W. D. Holway* 210H, & *L. H. Bailey, Jr.* (MIN-7745, as *A. thalictri* on *T. purpurascens*); Fargo, Cass Co., ND, 1915, *O. A. Stevens* (MIN-311002, under *P. agropyri*); same, *J. F. Brenckle* 894 & *Stevens* (MIN ex MPPD; Brenckle Fungi Dakotenses no. 339, issued as *P. agropyri*); Winnipeg, Manitoba, Canada, 1938, *Dominion Rust Research Laboratory* (PUR, under *P. agropyrina*);

- type 1 on *T. dioicum* L. (early meadow-rue), Lake Minnetonka, Hennepin Co., MN, 1909, *E. W. Norcross* (MIN ex MPPD-71, as *Aecidium thalictri-flavi*); Mille Lacs Lake, MN, 1892, *E. P. Sheldon* 2306 (MIN-7748, under *A. thalictri-flavi*); Missoula, MT, 1917, *E. Bartholomew & J. R. Weir* (MIN ex MPPD; Bartholomew's North American Uredinales no. 2132, issued as *P. clematidis*);
- type 1 on *T. fendleri* Engelm. ex A. Gray (Fendler's meadow-rue), Lake Tahoe, CA, 1923, *W. C. Blasdale* (MIN ex MPPD; Bartholomew's North American Uredinales no. 3341, as *P. clematidis*); Cow Camp Canyon, CO, 1899, *E. Bartholomew* (MIN ex MPPD, as *P. agropyri*); Eldora, CO, 1910, *E. Bethel* (MIN-310997, as *P. alternans*); Manitou, Colo., 1916, *J. M. Bates* (MIN ex MPPD; Bartholomew's North American Uredinales no. 2029, as *P. clematidis*); Salt Lake City, UT, 1904, *A. O. Garrett* (MIN-311022);
- type 1 on *T. fendleri* var. *polycarpum* Torrey (Fendler's meadow-rue; *T. polycarpum* (Torrey) S. Wats.), Longvale, CA, 1936, *J. P. Tracy* (MIN-668969);
- type 1 on *T. flavum* L. (common or yellow meadow-rue), Lafayette, IN (culture), 1933, *R. M. Caldwell* (PUR);
- type 1 on *T. minus* L. var. *hypoleucum* (Sieb. & Zucc.) Miq. (aki-karamatsu, low meadow-rue; *T. thunbergii* deCandolle var. *hypoleucum* Nakai), Wakkanai, Hokkaido, Japan, 1985, *Y. Ono* 1583 (PUR); Mount Nantaisan, Ibaraki Prefecture, Japan, 1992, *K. Higuchi & K. Saganuma* (PUR);
- type 1 on *T. occidentale* A. Gray (western meadow-rue; *T. megacarpum* Torrey), Alpine, MT, 1921, *E. Bartholomew* 2656 (MIN ex MPPD; Bartholomew's North American Uredinales no. 2656, as *P. clematidis*); Corvallis, OR, 1915, *H. S. Jackson* (MIN-613010, as *P. rubigo-vera*); Forest Grove, OR, 1896, *M. Craig* 99 (MIN ex MPPD); Centennial, WY, 1911, *E. Bartholomew* (MIN-311028; Bartholomew's Fungi Columbiani no. 3739; from telia on *Agropyron tenerum* = *Elymus trachycaulus*); Jackson Lake, WY, 1920, *E. Bartholomew & Mrs. E. Bartholomew* 3236 (MIN); Banff, Alberta, Canada, 1901, *E. W. D. Holway* (MIN-311006, as *P. agropyri*); Grizzly Creek, Brit. Columbia, 1907, *Holway* (MIN-612994);
- type 1 on *T. thalictroides* (L.) Eames & Boivin (rue-anemone, windflower; *Anemonella thalictroides* (L.) Spach), Whitewater State Park, MN, 18 May 1991, *J. W. McCain* 2339 (MIN ex MPPD-40354); Sugar Grove, Fairfield Co., OH, 1891, *M. Craig* 2703 (MIN ex MPPD);
- type 1 on *T. sp.*, East Bruneau, ID, 1912, *A. Nelson & J. F. Macbride* (MIN-311035, as *P. rubigo-vera*); Brookings, SD, 1894, *Williams & Thornber* (MIN ex MPPD-

101); Brush Creek, WY, 1964, R. F. Cain (MIN-612993, as *P. rubigo-vera*); Maisa, Siberia, 1995, Y. Ono 95Ru8 (PUR).

7. *Puccinia triticina* Eriksson aeciospore type 1 on *Thalictrum speciosissimum* L. (dusty meadow-rue; *T. flavus* subsp. *glaucum* (Desf.) Battand.), Israel (from telia on *Triticum dicoccoides* Koern. ex Schweinf. = *T. turgidum* L.), 1996, comm. Y. Anikster;

8. *Puccinia* sp. type 1 aeciospores on *Berberis fendleri* (*Berberidaceae*), Colorado, 1995 (PUR).

9. *Uromyces halstedii* deToni aeciospore type 4 on *Trillium erectum* L. (red trillium, stinking Benjamin; *Liliaceae*), Taughannock, NY, 1915, H. H. Whetzel (MIN ex MPPD-40116);

-- type 4 on *T. flexipes* Raf. (declining trillium, nodding wakerobin), Curtain Falls Trail, Interstate State Park, ca. 1 mile south of Taylors Falls, Chisago Co., MN, 19 June 1996, J. W. McCain 4190 (PUR).

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<sup>1</sup> – Abbreviations of herbaria:

BPI – U. S. National Fungus Collections, Systematic Botany & Mycology Laboratory, U. S. Department of Agriculture, Beltsville, MD;

CUP – Plant Pathology Herbarium, Plant Pathology Department, Cornell University, Ithaca, NY;

MIN – The Minnesota Herbarium, College of Biological Sciences, University of Minnesota, St. Paul, MN;

MPPD – Department of Plant Pathology, University of Minnesota (now merged with MIN);

PUR – The J. C. Arthur Herbarium of Rust Fungi, Department of Botany and Plant Pathology, Purdue University, West Lafayette, IN;

TRTC – Mycological Herbarium, Royal Ontario Museum, Toronto, Ontario, Canada;

UC – University Herbarium, University of California at Berkeley;

US – Botanical Section, U. S. National Herbarium, Smithsonian Institution, Washington, D.C.