

MEMORANDA AND INDEX OF CULTURES OF UREDINEAE, 1899-1917¹

J. C. ARTHUR

The cultures of the rusts, which were conducted under the auspices of the Purdue University Agricultural Experiment Station, and extended over a period of nineteen years, had a small beginning. For the first three years only such time was given to the work as the writer could spare from his duties as head of the Botanical Department of the Station and as Professor of Vegetable Physiology and Pathology in Purdue University. In most of the following years an assistant was especially employed during two or so months each spring, who had entire charge of the testing of spore viability, sowing of the spores, and care of the inoculated plants, the chief part of the culture work being done during May and June. The position was held by fourteen individuals, selected with the needs of the work especially in view, and ranging from a junior high school student to university instructors, who without exception showed superior ability in conducting the work. Financial support was provided by a grant from the Botanical Society of America in 1903, 1906 and 1907, and by coöperation with the Bureau of Plant Industry of the U. S. Department of Agriculture in 1904 and 1905. In the other years it was supplied by the Purdue University Agricultural Experiment Station, and from 1908 onward the work was made a part of the rust project under the Adams fund.

During the progress of the work the writer, usually accompanied by an associate, made many shorter or longer excursions for securing data and material. These field observations were directed toward detecting the juxtaposition of spore-forms that might be supposed to have genetic connection, as well as toward securing suitable culture material. The fruitfulness of this method is apparent from the fact that during the extended study

¹ Contribution from the Botanical Department of the Purdue University Agricultural Experiment Station.

of heteroecious species only three times was a discovery of alternate hosts effected that was not the outcome of a previous field observation. In two of these cases, that of *Uromyces acuminatus* (more properly *U. Steironematis*, see page 76,* Jour. Myc. 12: 25), and *Puccinia Ceanothi* (see page 196,* Mycologia 4: 27) sowings were made on all available hosts in the greenhouse, recorded as bearing aecia, and in the case of *P. fraxinata* (*P. peridermiospora*, see page 8,* Bot. Gazette 29: 275), a morphological similarity was detected between aesciospores and urediniospores, leading to successful cultures.

Beginning with the immediate vicinity of Lafayette, Indiana, the range of observations was extended to various parts of the state, and in the ninth year of the work, 1907, to other states. This year a trip was made to the foothills of Colorado, which was repeated in 1908, 1911 and 1916, observations being made from Boulder to Trinidad, and once westward to Ouray and Durango. Between 1908 and 1916 trips were made northward to Wisconsin and Michigan, eastward to Maine and Pennsylvania, to South Carolina, Alabama and Mississippi in the south, and to Texas, New Mexico and Arizona in the southwest. So far as possible places were selected where there were local collectors, or where records showed that species requiring investigation had at some time been secured. The chief collecting grounds of Ellis in New Jersey, Ravenel in North and South Carolina, Atkinson and Underwood in Alabama, and Kellerman in Kansas were visited, and the collecting grounds of Schweinitz at Salem, North Carolina, and Bethlehem, Pennsylvania, would have been visited, if opportunity had favored. In this way many obscure names in the literature were connected with living material on which fresh and more extended studies, often including cultures, could be carried out. By this method the attention given to the genus *Gymnosporangium* was made to expand our limited knowledge of a few species into an understanding of the life history of some two dozen species and of their alternate hosts. The effectiveness of the work with *Gymnosporangium* was greatly enhanced by the special interest in it taken by my asso-

* For explanation of these page numbers see p. 246 at beginning of the index.

ciate, Dr. F. D. Kern, who for ten years took part in the culture work. The grass and sedge rusts were, however, the ones that received the most extended and prolonged attention.

To carry on the work more than 2140 collections with resting spores were available, together with over 250 collections with spores not requiring a resting period. Tests of all of these, and of some many times repeated, showed that not all were viable, at least at the time tested, and therefore not serviceable. This material was provided in part by those directly connected with the work, and to a considerable extent by more than 85 botanical correspondents, many of whom contributed most generously in material and field observations year after year. Altogether about 3750 sowings, that is, attempts at cultures were made, of which about one in seven resulted in successful infection of the host. These tests were almost wholly made in a greenhouse, although a few were conducted in the open field when small plants suitable for placing in pots were not available.

It is difficult to say just how many species have been grown through some part of their life cycle during the nineteen-year period, owing to the constant shifting of accepted names as knowledge regarding them accumulated. Probably the list includes about one hundred species, as they are now rated, or nearly twice as many as they would at first have been listed, and of this number about eight were heteroecious to one autoecious. Of the heteroecious species some twenty were verifications of combinations previously established, mostly by European investigators, while about sixty-five provided alternate hosts for species whose life cycle was before unknown, most of these being grass and sedge forms not known outside of North America.

When viewing the present location of the New York Botanical Garden many years ago, it then being a rolling meadow without buildings of any kind, my companion, Professor L. M. Underwood, remarked that some day I might be called upon to supply the rust portion for the projected North American Flora, and added that if I did so he had no doubt that I would greatly reduce the number of species. The culture studies have enabled me to do this, but not quite in the way Professor Underwood

and others at that time had in mind. In many cases the first results have been to increase the number of species. Thus *Puccinia alternans* and *P. obliterated* were described as new species as result of cultures, but as the studies proceeded were reduced to synonyms of the long recognized *P. Agropyri*, together with *Aecidium Aquilegiae*, *A. Clematidis*, *Puccinia tomipara*, *P. Paniculariae*, and some others. But on the whole, as the cultures have largely dealt with heteroecious species, there has been a reduction in names as the alternate forms were brought together, and sometimes by the recognition as races of forms that were once thought distinct species.

The nomenclature of the reports has been made as conservative as possible, in order to give them reasonable uniformity. The new generic names proposed by the writer in 1906 at the Vienna Congress scarcely find an echo in them, while on the other hand the terminology for spore-forms, brought out in 1905, was put into use in the second report following, and proved highly serviceable.

In the various reports of the cultures, and as a result of them, the following thirteen specific names were transferred to other genera: *Aecidium magnatum* Arth. and *A. Silphii* Sydow to *Uromyces*, *Aecidium Ceanothi* Peck, *A. Impatientis* Schw., *A. Jamesianum* Peck, *A. macrosporum* Peck, *A. monoicum* Peck, *A. Pammelii* Trel., *A. Phrymae* Halst., *A. pustulata* Curt., *A. Sambuci* Schw. to *Puccinia*, and *Puccinia tumidipes* Peck and *P. Vernoniae* Berk. & Curt. to *Bullaria*.

Also as the result of the cultures the following sixteen species were described as new: *Gymnosporangium corniculans* Kern, *G. exterum* Arth. & Kern, *G. trachysorum* Kern, and on the authority of the writer *Puccinia albiperidia*, *P. alternans*, *P. Caricis-Asteris*, *P. Caricis-Erigerontis*, *P. Caricis-Solidaginis*, *P. Eatoniae*, *P. Koeleriae*, *P. obliterated*, *P. patruelis*, *P. universalis*, *Uromyces effusus*, *U. Solidagini-Caricis*, and *U. Steironematis*, but as the result of further studies most of these were subsequently buried in synonymy.

CORRECTIONS

In making corrections the consecutive page numbers used are those explained below at the beginning of the index, while the original pages are given in parentheses. A few of the corrections are typographical errors, or slips of the pen, but many are necessitated by information variously acquired after the reports were written and printed. Evident and inconsequential errors are not included. To save space the following abbreviations are used in the parentheses: B.G. for Botanical Gazette, J.M. for Journal of Mycology, and My. for Mycologia, and are followed by the original volume and page number.

Pages 5, 9 (B.G. 29: 272, 276), under 7 and 3 respectively, for "Americana Lagh." and "Americana," read *Andropogonis* Schw. and *Andropogonis*, respectively, and for "Andropogi Schw." and "Andropogi," read *Ellisiana* Thüm. and *Ellisiana*, respectively.

Pages 7, 9, 22, 28 (B.G. 29: 274, 276; 35: 16, 22), for "K. & S.," read E. & K.

Pages 8, 31, 51, 60, 67, 75, 76, 77, 78, 83, 103, 106, 114, 127, 146, 156, 160, 164, 174 (B.G. 29: 275; J.M. 10: 9; 11: 57, 66; 12: 16, 24, 25, 26, 27; 13: 192; 14: 14, 17, 25; My. 1: 236, 255; 2: 221, 225, 229, 239), for the species of *Spartina*, given as "*cynosuroides*" or "*cynosuroides* Willd.," read *Michauxiana* or *Michauxiana* Hitchc. The two species of grass were for a time confused and one name used for both.

Pages 11, 65, 77, 86, 94 (J.M. 8: 52; 12: 14, 26; 13: 196, 204), for a species of *Carex*, for "tetanica" and "tetanica Schk.," read *blanda* and *blanda* Dewey, respectively.

Pages 17, 45, 49, 50, 60 (B.G. 35: 11; J.M. 11: 51, 55, 56, 66), for the species of *Lepidium*, given as "*apetalum*" and "*apetalum* Willd.," read *densiflorum* and *densiflorum* Schrad., respectively.

Page 26 (B.G. 35: 20), the *Aecidium* mentioned under 5. P. AMPHIGENA was subsequently found not to be *A. Smilacis* Schw.

Pages 41, 42 (J.M. 10: 19, 20). The supposed infection in 1903 of *Bromus ciliatus* by the application of aeciospores from *Dirca palustris* was the most serious error that occurred in the nineteen years of culture work. The grass used for the culture was undoubtedly infected before the sowing was made, as explained on pages 56 and 57 of the report following. The combination of aecia and telia under the name "*Puccinia hydnoidea*," was unwarranted. The *Aecidium hydnoideum* was under close observation during the whole culture period, and there were a score of attempts to find the alternate host, but even to the present writing no progress has been made.

Pages 49, 50 (J.M. 11: 55, 56), under no. 4, for the species of *Sophia* from Nebraska, given as "*incisa* (Engelm.) Greene," read *intermedia* Rydb.

Pages 49, 60, 68, 77 (J.M. 11: 55, 66; 12: 17, 26), for the species of *Sophia* from Indiana used in the cultures, given as "*incisa*" and "*incisa* (Engelm.) Greene," read *brachycarpa* and *brachycarpa* Rydb.

Pages 51, 60, 67, 77, 103, 114, 127, 146, 160, 174, (J.M. 11: 57, 66; 12: 16, 26; 14: 14, 25; My. 1: 236, 255; 2: 225, 239), after *Puccinia fraxinata*, for "Schw.," read Link.

Page 62, first line of reprint, for "1," read 12.

Page 64 (J.M. 12: 13), under no. 6, for "Schw.," read Desmaz.

Pages 66, 77 (J.M. 12: 15, 26), under no. 7, for specific name "*aquatilis*" and "*aquatilis* Wahl.," read *nebraskensis* and *nebraskensis* Dewey. On page 66 the comparison of the large, thick-walled urediniospores (common on this host, the form being known as *Puccinia Garrettii* Arth.) to the amphispores of *P. Caricis-stictae* was an error. It may be pointed out here that the same mistake regarding name of the host also occurs in Sydow, *Uredineen* 2115, Barth. *Fungi Columb.* 2351 and 3838. *Carex nebraskensis* is a very common sedge about Denver and Boulder, Colo., while *C. aquatilis* is rare or possibly absent.

Pages 85, 92, 94 (J.M. 13: 195, 202, 204), under *Lactuca*, for "*virosa*," read *scariola*.

Pages 93, 95, 107, 114, 130, 146, 195, 201 (J.M. 13: 203, 205; 14: 18, 25; My. 1: 239, 255; 4: 26, 32), under *Gymnosporangium*, for "*Nelsoni* Arth.," read *juvenescens* Kern, and also delete the last sentence under no. 19 on page 107 (J.M. 14: 18). *Gymnosporangium Nelsoni* and *G. juvenescens* were for a time confused. Both produce aecia on *Amelanchier* and *Sorbus*, but the former gives rise to woody galls, often very small, while the latter is foliicolous.

Page 96, first line of the reprint for "1907," read 1908.

Pages 100, 180 (J.M. 14: 11; My. 4: 11), under *Puccinia*, for "*montanensis* Ellis," read *Agropyri* Ellis & Ev., as pointed out on page 263 (My. 8: 139).

Pages 109, 115 (J.M. 14: 20, 26), under no. 2, for "*Cryptandri* Ellis & Barth.," read *substerilis* Ellis & Ev., and for "*Sporobolus cryptandrus* (Torr.) A. Gray," read *Stipa viridula* Trin.

Pages 112, 115 (J.M. 14: 23, 26), under no. 6, for "*mutabilis* Ellis & Gall.," read *Blasdalei* Diet. & Holw., for "*reticulatum* Fraser," read *Brandegei* S. Wats., and for "*recurvatum* Rydb.," read *cernuum* Roth.

Page 123 (My. 1: 232), under no. 11, for "*Aster arenarioides* D. C. Eaton," read *Erigeron arenarioides* A. Gray.

Pages 129, 130, 146 (My. 1: 238, 239, 255), the small form of *Gymnosporangium* on *Juniperus virginiana*, which gave rise to pycnia and aecia on *Crataegus punctata*, should have been referred to *G. floriforme* Thaxter.

Page 133 (My. 1: 242), delete the entire paragraph beginning "The aecia of this species," etc., except the first sentence.

Page 147 (My. 1: 256), under no. 8, for "*glomerata*," read *mexicana* (L.).

Page 173 (My. 2: 238), under no. 1, change the reading thus: Teliospores on *Carex lanuginosa* Michx., sown on *Onagra biennis* (L.) Scop., and on *C. trichocarpa* Muhl. sown on *Gaura biennis* L.

Pages 178, 180 (My. 4: 9, 11), 19th and 6th line from bottom respectively, for "*Douglasii*," read *spartioides*.

Pages 180, 189, 197, 200, 231 (My. 4: 11, 20, 28, 31; 7: 72), as a species of *Senecio*, for "*lugens*" or "*lugens* A. Gray," read *spartioides* or *spartioides* T. & G., respectively.

Pages 197, 202 (My. 4: 28, 33), under no. 2, the material in hand from Isle au Haut, Me., was *Puc. quadriporula* (*P. Grossulariae*), but the results of infection were obtained from stray spores of *Uromyces perigynius*, as explained at page 235 (My. 7: 76) in the report of cultures for 1912.

Pages 256, 265 (My. 8: 132, 141), under no. 4, for "Agropyri E. & Ev. (*P. alternans* Arth.)," read Cockerelliana Bethel. This distinctive species was not recognized, and had not been named until long after the cultures were made.

Pages 257, 265, (My. 8: 133, 141), under no. 5, for "*Anchusa officinalis*," read *Lycopsis arvensis*.

Pages 261, 263, 265 (My. 8: 137, 139, 141), under no. 3, for "montanensis Ellis" and "montanensis," read apocrypta Ellis & Tracy and apocrypta, respectively. On page 262 three species are confused. *Puccinia apocrypta* is not a synonym of *P. Agropyri*. The characters given for *P. apocrypta* are those of the true *P. montanensis*, for which the type is the collection cited.

Pages 274, 275 (My. 9: 302, 303), under no. 2, for "B. & C." read Schw.

SUMMARY OF CULTURES

In order to give a clearer perspective of the work, and to make the data more readily available, the following tabulation is given of the heteroecious species that were successfully grown on alternate hosts. Autoecious species, and heteroecious species grown from urediniospores or amphispores only, have not been included. The years are those in which successful cultures were carried out. Only such synonymy is given as will account for the names used at different times in the reports. The page numbers are those explained below at the beginning of the index. Pages in broad faced type indicate the host from which spores were taken for culture, while pages in common type indicate the host on which the culture was successfully established.

Year	Rust	Telial host	Aecial host
1904 1905	<i>Puc. Sorghi</i> Schw.	<i>Zea Mays</i> 59, 68	<i>Oxalis corniculata</i> (O. <i>cymosa</i>) 59, 68
1909	<i>Puc. Ceanothi</i> (E. & K.) Arth.	<i>Andropogon Hallii</i> 168	<i>Ceanothus americana</i> 168
1912	<i>Puc. Ellisiana</i> Thüm.	<i>Andropogon</i> sp. 230	<i>Viola cucullata</i> 230 <i>V. Nuttallii</i> 230
1899 1903 1906 1910	<i>Puc. Andropogonis</i> Schw. (<i>P. americana</i> Lagerh.)	<i>Andropogon scoparius</i> 5, 6, 33, 87, 186 <i>A. virginicus</i> 186	<i>Pentstemon hirsutus</i> (P. <i>pubescens</i>) 5, 6, 33, 87, 186 <i>P. alpinus</i> 186
1903 1905 1910	<i>Puc. pustulata</i> (Curt.) Arth.	<i>Andropogon furcatus</i> 39, 67, 186 <i>A. scoparius</i> 39	<i>Comandra umbellata</i> 39, 67, 186
1904 1905 1907	<i>Puc. Pammelii</i> (Trel.) Arth. (<i>P. Panici</i> Diet.)	<i>Panicum virgatum</i> 50, 67, 105	<i>Euphorbia corollata</i> 50, 67 <i>E. marginata</i> 105
1901 1904 1905 1906 1907 1909 1910 1916	<i>Puc. poculiformis</i> (Jacq.) Wettst. (<i>P.</i> <i>graminis</i> Pers.)	<i>Agropyron pseudorepens</i> 162 <i>A. repens</i> 51 <i>A. Smithii</i> 270 <i>A. tenerum</i> 51, 105, 187 <i>Agrostis alba</i> 68, 88, 187 <i>Avena sativa</i> 105 <i>Cinna arundinacea</i> 12 <i>Elymus canadensis</i> 51, 88, 270 <i>Hordeum vulgare</i> 88 <i>Sitanion longifolium</i> 162, 187 <i>Sporobolus cryptandrus</i> 270 <i>Triticum aestivum</i> (T. <i>vulgare</i>) 88, 162	<i>Berberis vulgaris</i> 12, 51, 68, 88, 105, 162, 187, 270
1917	<i>Puc. Majanthae</i> (Schum.) Arth.	<i>Phalaris arundinacea</i> 278	<i>Iris versicolor</i> 278
1904 1910 1912	<i>Puc. Stipae</i> Arth.	<i>Koeleria cristata</i> 189 <i>Stipa comata</i> 231 <i>S. spartea</i> 58, 188	<i>Aster ericoides</i> 58, 188 <i>A. multiflorus</i> 58, 188 <i>A. Novae-Angliae</i> 58, 188 <i>Grindelia squarrosa</i> 188 <i>Gutierrezia Sarothrae</i> 231 <i>Senecio spartioides</i> 189, 231 <i>Solidago canadensis</i> 188

Year	Rust	Telial host	Aecial host
1917	<i>Puc. Sporoboli</i> Arth.	<i>Sporobolus heterolepis</i> 280	<i>Allium cernuum</i> 280 <i>A. Nuttallii</i> 280 <i>Lilium umbellatum</i> 280
1899 1902 1904 1905	<i>Puc. verbenicola</i> (E. & K.) Arth. (<i>P. Vilfae</i> Arth. & Holw.)	<i>Sporobolus longifolius</i> 7, 22, 50, 67	<i>Verbena stricta</i> 7, 22 <i>V. urticifolia</i> 22, 50, 67
1902 1904 1905 1906 1907 1908 1909 1910 1911 1915 1916 1917	<i>Puc. subnitens</i> Diet.	<i>Distichlis spicata</i> 25, 49, 68, 87, 104, 126, 160, 188, 208, 259, 273, 278	<i>Abronia fragrans</i> 273 <i>Atriplex hastata</i> 126, 160, 208 <i>Bursa Bursa-pastoris</i> 68, 104 <i>Chenopodium album</i> 25, 87, 104, 126, 160, 188, 208, 259, 278 <i>Cleome spinosa</i> 49, 208 <i>Erysimum asperum</i> 49, 68 <i>Lepidium densiflorum</i> (<i>L. apetalum</i>) 49 <i>L. virginicum</i> 49, 68 <i>Polygonum aviculare</i> 273 <i>Sarcobatus vermiculatus</i> 87, 126 <i>Sophia brachycarpa</i> 49, 68
1908 1909 1910 1914 1916	<i>Puc. Muhlenbergiae</i> Arth. & Holw. (<i>P. tosta</i> Arth.)	<i>Muhlenbergia gracillima</i> 271 <i>M. mexicana</i> 142 <i>M. racemosa</i> (<i>M. glom- erata</i>) 161, 187 <i>Schedonnardus panicu- latus</i> 272 <i>Sporobolus asperifolius</i> 240, 241	<i>Callirhoe involucrata</i> 142, 161, 187 <i>Malvastrum coccineum</i> 271, 272 <i>Sphaeralcea digitata</i> 241 <i>S. incana</i> 240 <i>S. lobata</i> 241
1902 1903 1905 1907 1909 1910	<i>Puc. amphigena</i> Diet.	<i>Calamovilfa longifolia</i> 26, 33, 67, 104, 160, 187	<i>Smilax herbacea</i> 26 <i>S. hispida</i> 26, 33, 67, 104, 160, 187
1911 1912	<i>Puc. monoica</i> (Peck) Arth.	<i>Koeleria cristata</i> 234 <i>Trisetum majus</i> 213 <i>T. subspicatum</i> 213, 234	<i>Arabis</i> sp. 213, 234
1904 1910 1916	<i>Puc. Rhamni</i> (Pers.) Wettst. (<i>P. coronata</i> Corda)	<i>Agrostis</i> sp. 271 <i>Avena sativa</i> 52 <i>Calamagrostis canadensis</i> 187	<i>Rhamnus alnifolia</i> 187 <i>R. caroliniana</i> 52 <i>R. cathartica</i> 52 <i>R. lanceolata</i> 52 <i>R. Purshiana</i> 271

Year	Rust	Telial host	Aecial host
1899 1904 1905 1907 1908 1909	<i>Puc. fraxinata</i> (Link) Arth. (<i>P. peridermi- ospora</i> Arth.)	<i>Spartina Michauxiana</i> (not <i>S. cynosuroides</i>) 8, 51, 67, 103, 160 <i>S. polystachya</i> 127 <i>S. stricta</i> 127	<i>Fraxinus lanceolata</i> (F. <i>viridis</i>) 8, 51, 67, 103, 127, 160
1915 1916	<i>Puc. Distichlidis</i> E. & F. (<i>P. Kelseyi</i> Syd.)	<i>Spartina Michauxiana</i> 261, 271	<i>Steironema ciliatum</i> 261, 271
1905 1908 1910 1915	<i>Puc. Seymouriana</i> Arth.	<i>Spartina cynosuroides</i> 259 <i>S. Michauxiana</i> (not <i>S.</i> <i>cynosuroides</i>) 75, 127, 188, 258	<i>Apocynum cannabinum</i> 258 <i>Asclepias syriaca</i> 259 <i>Cephalanthus occident- alis</i> 75, 127, 188
1902 1910	<i>Puc. Jamesiana</i> (Peck) Arth. (<i>P. Bartholo- maei</i> Diet.)	<i>Bouteloua curtipendula</i> (<i>Atheropogon curti- pendulus</i>) 24, 188	<i>Asclepias incarnata</i> 24 <i>A. syriaca</i> 24, 188
1899 1907 1909 1911	<i>Puc. Phragmitis</i> (Schum.) Körn.	<i>Phragmites communis</i> (<i>P. Phragmites</i>) 2, 104, 160, 208	<i>Rumex crispus</i> 2, 104, 160, 208 <i>R. obtusifolius</i> 2
1902 1907	<i>Puc. simillima</i> Arth.	<i>Phragmites communis</i> (<i>P. Phragmites</i>) 26, 104	<i>Anemone canadensis</i> 26, 104
1899 1902 1904 1915	<i>Puc. Windsoriae</i> Schw.	<i>Tridens flavus</i> (<i>Triodia</i> <i>cuprea</i> , <i>Tricuspis ses- lerioides</i>) 6, 22, 50, 260	<i>Ptelea trifoliata</i> 6, 22, 50, 260
1903	<i>Puc. Eatoniae</i> Arth.	<i>Eatonia pennsylvanica</i> 40	<i>Ranunculus abortivus</i> 40
1908	<i>Puc. Koeleriae</i> Arth.	<i>Koeleria cristata</i> 138	<i>Mahonia Aquifolium</i> 138
1916	<i>Puc. Liatridis</i> (E. & A.) Bethel	<i>Koeleria cristata</i> 273	<i>Laciniaria punctata</i> 273
1910	<i>Puc. Crandallii</i> Pam. & Hume	<i>Festuca confinis</i> 196	<i>Symphoricarpos race- mosus</i> 196
1915	<i>Puc. Cockerelliana</i> Bethel	<i>Festuca Thurberi</i> 256	<i>Thalictrum dioicum</i> 256
1908 1915	<i>Puc. Asperifolii</i> (Pers.) Wettst.	<i>Secale cereale</i> 128, 257	<i>Lycopsis arvensis</i> 128, 257
1915	<i>Puc. apocrypta</i> Ellis & Tracy	<i>Agropyron tenerum</i> 262 <i>Elymus virginicus</i> 262	<i>Hydrophyllum capi- tatum</i> 262

Year	Rust	Telial host	Aecial host
1904	<i>Puc. Clematidis</i> (DC.)	<i>Agropyron biflorum</i> 140	<i>Anemone cylindrica</i> 232
1906	Lagerh. (<i>P. Agropyri</i>)	<i>A. pseudorepens</i> 105	<i>Aquilegia canadensis</i>
1907	E. & E., <i>P. tomipara</i>	<i>A. Smithii</i> 232	140, 161
1908	Trel., <i>P. cinerea</i> Arth.	<i>A. sp.</i> 161	<i>Clematis Drummondii</i>
1909	<i>P. alternans</i> Arth., <i>P. oblitterata</i> Arth.)	<i>Bromus purgans</i> 87, 127	242
1911		<i>B. ciliatus</i> 56	<i>C. ligusticifolia</i> 232
1912		<i>B. Porteri</i> 139	<i>C. virginiana</i> 56, 87, 105,
1914		<i>Elymus canadensis</i> 232	127
		<i>E. virginicus</i> 242	<i>Oxygraphis Cymbalaria</i>
		<i>Puccinellia airoides</i> 137, 208	(<i>Ranunculus Cymbalaria</i>) 137, 208
			<i>Thalictrum alpinum</i> 161
			<i>T. dioicum</i> 139
			<i>Viorna Scottii</i> 105
1902	<i>Puc. Impatiens</i>	<i>Elymus canadensis</i> 162	<i>Impatiens aurea</i> 25, 33,
1903	(Schw.) Arth.	<i>E. striatus</i> 161, 162	51, 161, 162
1904		<i>E. virginicus</i> 25, 33, 51,	
1909		162	
1907	<i>Puc. oblecta</i> Peck	<i>Scirpus americanus</i> 109	<i>Bidens cornata</i> 109
			<i>B. frondosa</i> 109
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1903	(Pers.) Lagerh. (<i>P. albiperidia</i> Arth.)	<i>C. blanda</i> 65, 86	<i>R. Cynosbati</i> 12, 33, 53,
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1907		182, 226, 254	<i>R. rotundifolium</i> 53, 86
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1914	<i>Puc. minutissima</i> Arth.	<i>Carex filiformis</i> 245	<i>Decodon verticillatus</i> 245
1907 1909 1910 1916	<i>Puc. universalis</i> Arth.	<i>Carex filifolia</i> 270 <i>C. stenophylla</i> 110, 159, 185	<i>Artemisia dracuncu- lodes</i> 110, 159, 185 <i>A. gnaphalodes</i> 270
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1901 1902 1904 1905 1907 1908 1909 1910 1912 1913 1914 1915	<i>Puc. Asterum</i> (Schw.) Kern (<i>P. extensicola</i> Plow., <i>P. Caricis-As- teris</i> Arth., <i>P. Caricis- Erigerontis</i> Arth., <i>P. Caricis-Solidaginis</i> Arth., <i>P. Dulichii</i> Syd.)	<i>Carex festiva</i> 159, 185 <i>C. festucea</i> 13, 22, 52 <i>C. foenea</i> 13, 14, 21 <i>C. Jamesii</i> 27 <i>C. retrorsa</i> 228 <i>C. rosea</i> 102 <i>C. scoparia</i> 184, 228, 229 <i>C. sparganioides</i> 66, 124 <i>C. stipata</i> 27 <i>C. sp.</i> 102 <i>C. vulpinoidea</i> 238, 240 <i>Dulichium arundi- naceum</i> 240, 254	<i>Aster adscendens</i> 159, 185 <i>A. cordifolius</i> 14, 102 <i>A. paniculatus</i> 13, 14, 21, 102, 228 <i>Erigeron annuus</i> 13, 22, 52 <i>E. philadelphicus</i> 22 <i>Euthamia graminifolia</i> 184, 229 <i>Leptilon canadense</i> 22 <i>Solidago caesia</i> 27 <i>S. canadensis</i> 27, 66, 124, 238, 240, 254 <i>S. glaberrima</i> 238 <i>S. mollis</i> 238 <i>S. rigida</i> 27 <i>S. rugosa</i> 238 <i>S. serotina</i> 27 <i>S. ulmifolia</i> 27
1902 1904 1905 1906 1908 1909 1910 1911	<i>Puc. Peckii</i> (DeT.) Kellerm.	<i>Carex lanuginosa</i> 52, 66, 85, 158, 184, 208 <i>C. stipata</i> 20, 124 <i>C. trichocarpa</i> 20, 21, 52, 85, 158, 184	<i>Gaura biennis</i> 158 <i>Meriolix serrulata</i> 184 <i>Onagra biennis</i> (<i>Oenothera biennis</i>) 20, 21, 52, 66, 85, 124, 158, 184, 208
1906 1908 1910	<i>Puc. patruelis</i> Arth. (<i>P. Opizii</i> Arth. not Bubák)	<i>Carex pratensis</i> 136 <i>C. siccata</i> 185 <i>C. sp.</i> 85	<i>Agoseris glauca</i> 136 <i>Lactuca canadensis</i> 85, 185 <i>L. sativa</i> 85, 185 <i>L. virosa</i> 85

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1901 1902 1904 1905 1906 1908	<i>Puc. Sambuci</i> (Schw.) Arth. (<i>P. Atkinsoni- ana</i> Diet., <i>P. Bolley- ana</i> Sacc.)	<i>Carex Frankii</i> 85 <i>C. lupulina</i> 65 <i>C. lurida</i> 21, 124 <i>C. trichocarpa</i> 14, 21, 52	<i>Sambucus canadensis</i> 14, 21, 52, 65, 85, 124
1904 1905	<i>Puc. Polygoni-amphibii</i> Pers.	<i>Polygonum emersum</i> 53, 69, 53	<i>Geranium maculatum</i> 53, 69
1910	<i>Puc. argentata</i> (Schultz) Wint.	<i>Impatiens aurea</i> 189	<i>Adoxa Moschatellina</i> 189
1909	<i>Urom. Andropogonis</i> Tracy	<i>Andropogon virginicus</i> 163	<i>Viola cucullata</i> 163
1902 1917	<i>Urom. seditiosus</i> Kern (<i>U. Aristidae</i> Auth. not E. & E.)	<i>Aristida basiramea</i> 279 <i>A. oligantha</i> 23	<i>Plantago aristata</i> 279 <i>P. lanceolata</i> 279 <i>P. Rugelii</i> 23
1916	<i>Urom. Sporoboli</i> E. & E.	<i>Sporobolus virginiae- florus</i> 274	<i>Allium stellatum</i> 274
1915	<i>Urom. Hordei</i> Tracy	<i>Hordeum pusillum</i> 263	<i>Notkoscordium striatum</i> 263
1911	<i>Urom. Peckianus</i> Farl.	<i>Distichlis spicata</i> 209	<i>Atriplex hastata</i> 209
1905 1907 1909 1910 1912 1917	<i>Urom. Polemonii</i> (Peck) Barth. (<i>U. acumina- tus</i> Arth., <i>U. Spar- tinae</i> Farl., <i>U. Steir- onematis</i> Arth., <i>U. magnatus</i> Arth.)	<i>Spartina Michauxiana</i> 76, 106, 164, 198, 236, 282	<i>Collomia linearis</i> 236 <i>Polemonium reptans</i> 198 <i>Polygonatum biflorum</i> 282 <i>P. commutatum</i> 282 <i>Steironema ciliatum</i> 76, 106, 164 <i>S. lanceolatum</i> 164 <i>Vagnera stellata</i> 282
1906 1907 1908 1914	<i>Urom. Scirpi</i> (Cast.) Burr.	<i>Scirpus fluviatilis</i> 89, 106, 128, 242	<i>Cicuta maculata</i> 89, 106, 128 <i>Sium cicutaefolium</i> 242
1903 1910 1912 1914 1917	<i>Urom. perigynius</i> Halst. (<i>U. Solidagini- Caricis</i> Arth.)	<i>Carex deflexa</i> 190 <i>C. intumescens</i> 190, 234 <i>C. sparganioides</i> 279 <i>C. tribuloides</i> 242 <i>C. varia</i> 37	<i>Aster ericoides</i> 190 <i>A. paniculatus</i> 190, 234 <i>A. Tweedyi</i> 242 <i>Rudbeckia laciniata</i> 279 <i>Solidago caesia</i> 37 <i>S. canadensis</i> 37, 234 <i>S. flexicaulis</i> 37 <i>S. serotina</i> 37 <i>S. rugosa</i> 190

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1910 1912	<i>Urom. Junci</i> (Desm.) Tul.	<i>Juncus balticus</i> 191, 236	<i>Ambrosia artemisiae-</i> <i>folia</i> 191 <i>A. psilostachya</i> 191 <i>A. trifida</i> 191 <i>Carduus Flodmanii</i> 191, 236
1906 1907	<i>Urom. Silphii</i> (Syd.) Arth.	<i>Juncus tenuis</i> 92, 106	<i>Silphium perfoliatum</i> 92, 106
1908	<i>Urom. houstoniatus</i> (Schw.) Sheldon	<i>Sisyrinchium gram-</i> <i>ineum</i> 129	<i>Houstonia caerulea</i> 129
1908 1911	<i>Gym. Libocedri</i> (P. Henn.) Kern	<i>Libocedrus decurrens</i> 143, 211	<i>Amelanchier vulgaris</i> 211 <i>Crataegus cerronis</i> 211 <i>C. Pringlei</i> 143 <i>C. tomentosa</i> 211
1907 1911	<i>Gym. inconspicuum</i> Kern	<i>Juniperus utahensis</i> 113, 211	<i>Amelanchier erecta</i> 113 <i>A. vulgaris</i> 211
1909	<i>Gym. exiguum</i> Kern	<i>Juniperus virginiana</i> 169	<i>Crataegus Pringlei</i> 169
1908 1910	<i>Gym. Davisii</i> Kern	<i>Juniperus sibirica</i> 132, 194	<i>Aronia arbutifolia</i> 194 <i>A. nigra</i> 132, 194
1906 1907 1908 1910	<i>Gym. juvenescens</i> Kern	<i>Juniperus scopulorum</i> 93, 107, 130 <i>J. virginiana</i> 195	<i>Amelanchier canadensis</i> 93, 107 <i>A. erecta</i> 107, 130, 195 <i>A. intermedia</i> (A. <i>Botryapium</i>) 107 <i>Sorbus americana</i> 93, 107, 130
1911	<i>Gym. Kernianum</i> Bethel	<i>Juniperus utahensis</i> 216	<i>Amelanchier vulgaris</i> 216
1909	<i>Gym. trachysorum</i> Kern	<i>Juniperus virginiana</i> 172	<i>Crataegus cerronis</i> 172 <i>C. coccinea</i> 172 <i>C. punctata</i> 172
1908 1914	<i>Gym. Botryapites</i> (Schw.) Kern	<i>Chamaecyparis thyoides</i> 131, 242, 243	<i>Amelanchier canadensis</i> 242, 243 <i>A. intermedia</i> 131
1907 1909 1910 1911 1914	<i>Gym. nidus-avis</i> Thax.	<i>Juniperus virginiana</i> 108, 129, 165, 194, 210, 242	<i>Amelanchier erecta</i> 210 <i>A. vulgaris</i> 194, 242 <i>Crataegus Pringlei</i> 165 <i>Cydonia vulgaris</i> 194 <i>Malus coronaria</i> 129, 210 <i>M. Malus</i> 108, 129 <i>M. icensis</i> 165

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1907 1908 1909 1910	<i>Gym. clavipes</i> C. & P.	<i>Juniperus sibirica</i> 107, 164, 193 <i>J. virginiana</i> 130	<i>Amelanchier erecta</i> 107, 164, 193 <i>A. intermedia</i> 107 <i>Crataegus punctata</i> 164 <i>C. tomentosa</i> 193 <i>C. sp.</i> 130
1908 1909 1910	<i>Gym. cornutum</i> (Pers.) Arth.	<i>Juniperus sibirica</i> 131, 165, 194	<i>Sorbus americana</i> 131, 165, 194 <i>S. aucuparia</i> 165
1908 1909	<i>Gym. exterum</i> Arth. & Kern	<i>Juniperus virginiana</i> 144, 166	<i>Porteranthus stipulatus</i> 144, 166
1911	<i>Gym. juniperinum</i> (L.) Mart. (<i>G. tremel-</i> <i>loides</i> Hartig)	<i>Juniperus sibirica</i> 211	<i>Sorbus americana</i> 211
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1907 1908 1910 1911 1913	<i>Gym. clavariaeforme</i> (Jacq.) DC.	<i>Juniperus sibirica</i> 108, 130, 194, 210, 238	<i>Amelanchier erecta</i> 130, 194, 210 <i>A. intermedia</i> 108 <i>Crataegus cerronis</i> 238 <i>C. punctata</i> 194
1914	<i>Gym. Ellisii</i> (Berk.) Farl.	<i>Chamaecyparis thyoides</i> 246	<i>Myrica cerifera</i> 246
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1908 1909	<i>Gym. floriforme</i> Thax.	<i>Juniperus virginiana</i> 129, 166	<i>Crataegus coccinea</i> 166 <i>C. punctata</i> 129
1905 1906 1907 1908 1910	<i>Gym. Juniperi-virginianae</i> Schw.	<i>Juniperus virginiana</i> 64, 90, 106, 129, 193	<i>Malus coronaria</i> 90, 129 <i>M. Malus</i> (<i>Pyrus Malus</i>) 64, 106, 129, 193
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Names in *italics* are synonyms.

Numbers in broad-faced type indicate successful cultures.

Numbers in square brackets refer to pages (1) where the common name is used for the species instead of the Latin name, or (2) where the name occurs but is not the species intended and not a synonym (*e.g.*, *Anchusa officinalis* for *Lycopsis arvensis*), or (3) where the name does not occur but some other name not a synonym (the error being due to wrong identification, *e.g.*, *Gymnosporangium Nelsoni* used for *G. juvenescens*, or to common but erroneous usage, *e.g.*, *Spartina cynosuroides* for *S. Michauxiana*).

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Arthur, Joseph Charles. 1921. "Memoranda and index of cultures of Uredineae, 1899-1917." *Mycologia* 13(4-5), 230-262.

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