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INDEX TO UREDINEOUS CULTURE EXPERIMENTS WITH LIST OF SPECIES AND HOSTS FOR NORTH AMERICA.

W. A. KELLERMAN.

(Abstract.)

Careful culture work to determine life histories of fungi or cycles of development was initiated by De Bary in 1865. It was continued by him in 1866 and in the same year also taken up by Oersted and Woronin. A few years later other foreign botanists engaged in similar work, and the list continued to the present contains such additional names as Schroeter, Rostrup, Winter, Schenk, Cornu, Plowright, Klehban, Hartig, Dietel, Barclay, Fischer, Tubeuf, Soppit, Tranzschal, Eriksson, Pazschke, Juel, Wagner, Bubak, Jacky, Shirai, Müller and Ward.

In America Dr. Farlow was the pioneer worker, publishing his first experiments on the "Gymnosporangia or Cedar Apples of the United States" in 1880. He continued work on the same group in 1885, and it was supplemented (independently) by Halsted in 1886–7, published in the Bulletin of the Iowa Agricultural
College. More fruitful results were obtained by Thaxter in 1887 and again in 1889,—the connection between the several species of Gymnosporangium and associated Roestelia occurring in this country being satisfactorily established, which may be found in print in the Proceedings of the American Academy of Arts and Sciences, Boston; and Bulletin 134, Conn. Agr. Exp. Sta. Pamela repeated the experiment verifying connection in case of one of the species (Ia. Hort. Soc. Rep. 1893), the same also by Stewart and Carver (Proc. Ia. Acad. Sci. for 1895, Vol. 3; same in N. Y. Exp. Sta. for 1895).

No connections between Uredineous forms were then experimentally determined—except that Howell (in 1890) showed the three stages of the Clover Rust to be genetically related, and Clinton (in 1894) the two stages of the Bramble Rust—until 1899, when extended and important work was reported by Arthur and by Carleton. The latter dealt with the Cereal Rusts only, making sowings almost exclusively of Uredospores mainly from Wheat, Oats, Barley, Rye and Maize, on the same and on different host species. The interesting results were published as Bulletin No. 16, U. S. Dept. Agr. Div. Veg. Physiology and Pathology, April 23, 1899.

Arthur communicated his first results to the public in a paper read before the A. A. A. S., Botanical Section, Columbus, Ohio, August, 1889, and the same was published in the Botanical Gazette, 29:268-276, April, 1900. Of eleven species of Uridineae, the aecidial and teleutosporic forms were definitely connected by these cultures. In the Journal of Mycology (8:51-6), June, 1902, he reported cultures made in 1900 and 1901—successful inoculations in eight cases, four being repetitions of previously demonstrated connections, and the complete cycle for four being reported here for the first time. Arthur's third report (cultures in 1902) was published in the Botanical Gazette (35:10-23) for January, 1903. The successful cultures made number eleven previously reported and seven reported for the first time.

In 1902 cultures were undertaken by Kellerman. The first case of demonstrated connection was published in the Journal of Mycology (8:20), May, 1902, and appeared in the same periodical (9:6-13) in February, 1903. This showed seven successful inoculations, two of these not having been previously demonstrated. The second report (continuing his work during 1903), detailing more extended cultures, was given in part in the Journal of Mycology (9:109-10), May, 1903, and the year's work is reported in full in the Journal, December Number, 1903.

This brief historical outline shows that as yet comparatively few American mycologists have undertaken culture work to determine life cycles of our numerous species of Uredineae.
Space precludes giving here a detailed record of work by American botanists, but the paper in full is published in the Journal of Mycology, also printed on one side of page as a separate. The following is a summary of the alternate forms whose connection has been demonstrated:

**SUMMARY OF ALTERNATE FORMS.**

Aecidium albiperidium Arth.—Puccinia albiperidia Arth.
Aecidium asteratum Schw.—Puccinia caricis-asteris Arth.
Aecidium berberidis Pers.—Puccinia puculiformis (Jacq.) Wettst.
Aecidium calystegiae Desm.—Puccinia convolvuli Cast.
Aecidium caulicolum Kellerm.—Puccinia caulicola Tr. & Gall.
Aecidium cirsii-lanceolati Kellerm.—Puccinia cirsi lanceolati Schroet.
Aecidium ellisi Tr. & Gall.—Puccinia subnitens Diet.
Aecidium erigeronatum Schw.—Puccinia caricis-erigerontis Arth.
Aecidium euphorbiae Am. Auct.—Uromyces euphorbiae C. & P.
Aecidium fraxini Schw.—Puccinia fraxinata (Lk.) Arth.
Aecidium on Helianthus—Puccinia helianthi Schw.
Aecidium hibisciataum Schw.—Puccinia hibisciata (Schw.) Kellerm. (P. muhlenbergiae Arth. & Holw.)
Aecidium impatients Schw.—Puccinia impatients (Schw.) Arth. (P. rubigovera Auct. on Elymus virginicus.)
Aecidium jamesianum Pk.—Puccinia jamesiana (Pk.) Arth. (P. bartholomaei Diet.)
Aecidium on Larix decidua, see Caeoma on Larix decidua.
Aecidium lateripes Kellerm.—Puccinia lateripes B. & Rav.
Aecidium leucospermum B. & C.—Uromyces lespedezae-procumbentis (Schw.) Curt.
Aecidium lycopi Ger.—Puccinia angustata Pk.
Aecidium oenotherae Pk., see Aecidium peckii DeToni.
Aecidium pammelii Trel.—Puccinia punici Diet.
Aecidium peckii DeToni (Ae. oenotherae Pk.)—Puccinia peckii (DeToni) Kellerm. (P. caricis Auct. p. p.)
Aecidium pentstemonis Schw.—Puccinia andropogonis Schw.
Aecidium plantaginis Ces. (?) on Plantago rugelii Dec.—Uromyces aristidae E. & E.
Aecidium pteleae B. & C.—Puccinia windloriae Schw.
Aecidium postulatum Curt.—Puccinia postulata (Curt.) Arth.
Aecidium [ranunculacearum (?)] on Anemone canadensis L.—Puccinia simillima Arth.
Aecidium ranunculi Schw.—Puccinia eatoniae Arth.
Aecidium rhamni Pers.—Puccinia rhamni (Pers.) Wettst. (P. coronata Corda.)
Aecidium rubellum Pers.—Puccinia phragmitis Schum.
Aecidium sambuci Schw.—Puccinia sambuci (Schw.) Arth. (P. atkinsoniana Diet., P. bolleyana Sacc.)
Aecidium smilacis Schw.—Puccinia amphigena Diet.
Aecidium solidaginis Schw.—Puccinia caricis-solidaginis Arth.
Aecidium on Solidago—Uromyces solidagini-caricis Arth.
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Aecidium on Strophostyles helvola—Uromyces phaseoli (Pers.) Wint.
Aecidium on Trifolium, see Uromyces trifolii (A. & S.) Wint.
Aecidium urticae Schum.—Puccinia carisic (Schum.) Reb.
Aecidium verbenicola K. & S.—Puccinia vilfae A. & H.
Caeoma (Aecidium) erigeronatun Schw., see Aecidium erigeronatum Schw.
Caeoma (Aecidium) hibisciatum Schw., see Puccinia hibiscia (Schw.) Kellerm.
Caeoma on Larix decidua—Melampsora medusae Thüm. [M. populina Am. Auct.]
Caeoma miniata Am. Auct.—Phragmidium speciosum Fr.
Caeoma nitens Schw., see Gymnoconia interstitialis (Schlect.) Lagh.
Caeoma umariae Thüm.—Triphragmium umariae (Schum.) Lk.
Gymnoconia interstitialis (Schlecht.) Lagh., aecidium (Caeoma nitens Schw.), and teleuto (Puccinia peckiana Howe); autoecious.
Gymnosporangium bisepatum Ell.—Roestelia botryapites Schw.
Gymnosporangium clavariaeforme (Jacq.) Rees.—Roestelia lacerata (Sow.) Fr.
Gymnosporangium clavipes Cke. & Pk.—Roestelia aurantiaca Peck.
Gymnosporangium conicum Rees.—Roestelia cornuta (Ehrh.) Fr.
Gymnosporangium ellisii (Berk.) Farl.—Roestelia transversans Ellis (?).
Gymnosporangium globosum Farl.—Roestelia globosum ("lacerata z") Thaxter.
Gymnosporangium macropus Lk.—Roestelia pyrata Thaxter.
Gymnosporangium nids-avis Thaxter—Roestelia nids-avis Thaxter.
Melampsora medusae Thüm [M. populina Am. Auct.]—Caeoma on Larix decidua.
Melampsora populina Am. Auct., see Melampsora medusae Thüm.
Phragmidium speciosum Fr.—Caeoma miniata Am. Auct.
Puccinia albiperidia Arth., aecidium [albiperidium Arth.], uredo and teleuto; autoecious.
Puccinia americana Lagh., see Puccinia andropoginis Schw.
Puccinia amphigena Diet.—Aecidium stilacis Schw.
Puccinia andropoginis Schw. (P. americana Lagh.)—Aecidium pentstemonis Schw.
Puccinia angustata Pk.—Aecidium lycopi Ger.
Puccinia atkinsoniana Diet. see Puccinia sambuci (Schw.) Arth.
Puccinia bartholomaei Diet., see Puccinia jamesiana (Pk.) Arth.
Puccinia bolleyana Sacc., see Puccinia sambuci (Schw.) Arth.
Puccinia carisic (Schum.) Reb.—Aecidium urticae Schum.
Puccinia carisic-asteris Arth.—Aecidium asteratum Schw.
Puccinia erigerontis Arth.—Aecidium erigeronatum Schw.
Puccinia carisic-solidaginis Arth.—Aecidium solidaginis Schw.
Puccinia caulicola Tr. & Gall., aecidium [caulicolum Kellerm.], uredo and teleuto; autoecious.
Puccinia cirsi-lanceolati Schroet., aecidium [circsi-lanceolati Kellerm.], uredo and teleuto; autoecious.
Puccinia convolvuli Cast., aecidium [calystegiae Desm.], uredo and teleuto; autoecious.
Puccinia coronata Corda, see Puccinia rhamni (Pers.) Wettst.
Puccinia eatoniae Arth.—Aecidium ranunculi Schw.
Puccinia fraxinata (Lk.) Arth.—Aecidium fraxini Schw.
Puccinia graminis, see Puccinia puculiformis (Jacq.) Wettst.
Puccinia helianthi Schw., aecidium [Caema helianthi Schw.], uredo and
teleuto; autoecious.
Puccinia hibisciata (Schw.) Keller. (P. muhlenbergiae Arth. & Holw.)—
Aecidium hibisciatum Schw.
Puccinia hydnoidea (B. & C.) Arth.—Aecidium hydnoideum B. & C.
Puccinia impatients (Schw.) Arth. (P. rubigo-vera Auct. on Elymus virgin-
icus)—Aecidium impatients Schw.
Puccinia jamesiana (Pk.) Arth. (P. bartholomaei Diet.)—Aecidium jamesi-
num Pk.
Puccinia lateripes B. & Rav., aecidium [lateripes Kellerm.], uredo and
teleutospores; autoecious.
Puccinia muhlenbergiae Arth. & Hol., see Puccinia hibisciata (Schw.) Kel-
lerm.
Puccinia panici Diet.—Aecidium pammelii Trel.
Puccinia peckiana Howe, see Gymnoconia interstitialis (Schlecht.) Lagh.
Puccinia peckii (DeTon) Kellerm. (P. carici Am. Auct. p. p.)—Aecidium
peckii DeTon (Ae. oenotherae Pk.).
Puccinia puculiformis (Jacq.) Wettst.—Aecidium berberidis Pers.
Puccinia pustulata (Curt.) Arth.—Aecidium pustulatum Curt.
Puccinia rhamni (Pers.) Wettst. (P. coronata Corda)—Aecidium rhamni
Pers.
Puccinia rubigo-vera Am. Auct. on Elymus virginicus, see Puccinia impa-
tientis (Schw.) Arth.
Puccinia sambuci (Schw.) Arth. (P. atkinsoniana Diet., P. bolleyana Sacc.)
—Aecidium sambuci (Schw.) Arth.
Puccinia simillima Arth.—Aecidium [ranunculacearum (?)] on Anemone
canadensis L.
Puccinia subnitens Diet.—Aecidium ellisi Tr. & Gall.
Puccinia vilfiae A. & H.—Aecidium verbenicola K. & S.
Puccinia windsorae Schw.—Aecidium pteleae B. & C.
Roestelia aurantiaca Pk.—Gymnosporangium clavipes Cke. & Pk.
Roestelia botryapites Schw.—Gymnosporangium bisectum Ell.
Roestelia cornuta (Ehr.) Fr.—Gymnosporangium conicum Rees.
Roestelia globosum ("lacerata z") Thaxter—Gymnosporangium globosum
Farl.
Roestelia lacerata (Sow.) Fr.—Gymnosporangium clavariaeforme (Jacq.)
Rees.
Roestelia nidus-avis Thax.—Gymnosporangium nidus-avis Thaxter.
Roestelia pyrata Thaxter—Gymnosporangium macropus Lk.
Roestelia transformans Ell. (?)—Gymnosporangium ellisi (Berk.) Farl.
Triphragmium ulmariae (Schum.) Lk.—Caema ulmariae Thüm.
Uromyces aristidae E. & E—Aecidium plantaginis Ces. (?) on Plantago
rugieli Dec.
Uromyces solidagini-caricis Arth.—Aecidium on Solidago.
Uromyces euphorbiae C. & P.—Aecidium euphorbiae Am. Auct.
Uromyces lespedezae-procumbentis (Schw.) Curt., aecidium [leucospermum
B. & C.], uredo and teleuto; autoecious.
Uromyces phaseoli (Pers.) Wint., aecidium, uredo and teleuto; autoecious.
Uromyces trifolii (A. & S.) Wint., aecidium, uredo and teleuto; autoecious.