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HOST INDEX AND MORPHOLOGICAL CHARACTERIZATION OF THE GRASS RUSTS OF THE WORLD

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops
Research Branch

Plant Industry Station
Beltsville, Maryland

HOST INDEX AND MORPHOLOGICAL CHARACTERIZATION OF THE GRASS RUSTS OF THE WORLD

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Introduction

This host index and tabulation of the principal morphological characteristics of the rust fungi parasitic on the grasses has been compiled as a preliminary but necessary adjunct to a monographic study of the grass rust fungi of the world. The records have been compiled from many sources, including the Sydow's "Monographia Uredinearum", regional manuals, regional lists, specimens in the Arthur Herbarium and the National Fungus Collections, and indexes maintained by the author. While it is believed to be reasonably complete it is almost a certainty that records have been overlooked. Moreover, errors may exist in the listing of species and synonyms since only certain tribes, notably the Andropogoneae and the Chlorideae, have been studied in detail. From the author's point of view, the work required to bring additional refinement to the index and tabulation does not seem to be warranted. As a preliminary tool, however, the compilation appears to have some value if for no other reason than that the vast majority, at least, of the species of the rust fungi are assembled and characterized and the probable synonymy indicated.

The Host Index

The host index is by genera of the grasses with the tribe indicated for each genus. Following each genus are listed the species of rust fungi, including certain or probable synonyms, recorded as occurring on species of that genus. A Roman numeral follows each accepted or "good" species. This numeral refers to the one of the nine main morphological groups into which the species have been arbitrarily segregated. By itself, the numeral indicates certain of the morphological characteristics of the uredia of the species since the groups are based on uredial and urediospore morphology.
The characteristics of the groups follow:

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GROUP I: Uredia with paraphyses; urediospores echinulate; pores equatorial.
GROUP II: Uredia with paraphyses; urediospores echinulate; pores scattered.
GROUP III: Uredia with paraphyses; urediospores verrucose; pores equatorial. A hypothetical group since no species are known.
GROUP IV: Uredia with paraphyses; urediospores verrucose; pores scattered.
GROUP V: Uredia without paraphyses; urediospores echinulate; pores equatorial.
GROUP VI: Uredia without paraphyses; urediospores echinulate; pores scattered.
GROUP VII: Uredia without paraphyses; urediospores verrucose; pores equatorial.
GROUP VIII: Uredia without paraphyses; urediospores verrucose; pores scattered.
GROUP IX: Uredia not developed or unknown; species of uncertain characteristics, etc.

In only a few cases is the presence of paraphyses variable within a species as, for example, *Puccinia coronata sensu lat.* Since *P. coronata* has echinulate urediospores and scattered pores it is listed as "*Puccinia coronata* Cda. (II, VI)" to account for collections with or without paraphyses. Likewise, the arrangement of the pores is a remarkably stable character. The detection of pores is usually easy when they are equatorial but often difficult when they are scattered. The pores are most difficult to see in pale spores and easiest to see in pigmented spores. Because of the difficulty of making accurate counts, the number of pores in scattered-pored species is best viewed as an approximation. Even when the actual pores cannot be seen their location may be indicated by slight "cuticular caps" protruding over each pore or often the wall may be indented slightly at each pore. Pores are usually more readily observed in empty spores or in spores cleared in lactic acid, chloral hydrate solution, or glycerin-alcohol. Proper orientation of the spore, with the hilum as the point of reference, is essential in determining the arrangement of the pores. Despite the occasional variation and the implied difficulties the vast majority of the species are readily assignable in the group scheme. Verrucose, as used here, implies hemispherical warts, minute and densely grouped in most cases, while echinulate applies to conical points with the points usually spaced one micron or more apart. There are relatively few species that I consider to be truly verrucose.

The Data Tabulations

The species of the rust fungi are tabulated alphabetically under the groups. Following the species name are tabulated the urediospore wall color, the wall thickness, the number of germ pores, the spore sizes, whether the telia are covered or naked and, if covered, whether they have paraphyses, the color of the teliospore wall, the thickness of the side wall and the apical wall, the approximate maximum length of the pedicel, and special characteristics. Teliospores that are not smooth, those that are diorchidioid (septum mostly vertical), those that characteristically have more than one septum (rostrupioid), those with coronate apex, and those with the lower germ pore depressed rather than apical are indicated under "special". A few uredial characters, such as the development of amphispores, thickened apical wall, strongly incurved dorsally thick-walled (phakopsoroid) paraphyses, etc. are also so indicated. Thus, the principal features included in the average written description are presented in tabular form.

If one knows the genus of the rusted grass one can find the species recorded as parasitizing species of that genus and, by checking the data for each parasite, decide which species one probably has. Assuming that one does not know the identity of the host it is possible to arrive at an approximate identification by examining the data tabulated for the major group in which the collection belongs. For example, if telia of the collection are exposed then the species checked as having covered telia need not be considered; if the teliospore pedicels are 15 microns in length then those species with pedicels 30 microns or more could be disregarded, etc.

Appendices

Certain species "complexes" present such difficulty that solutions have not been attempted. Three (and there are more) of these complexes have been arbitrarily presented as three species in the index and the main data tabulations. The species are: 1) *Puccinia coronata sensu lat.*, 2) *Puccinia recondita sensu lat.* (*P. rubigo-vera*) and 3) *Uromyces dactylidis sensu lat.* Data for the "species" treated as synonyms are tabulated in appended lists, with the source of the data indicated for each. In *P. recondita* and *U. dactylidis* the differences involved between synonymous species are almost exclusively those of spore dimensions. Among the synonyms of *P. coronata*, in addition to diversity in spore dimensions, there are differences in the length of the digitations (crown), in the presence or abundance of uredial and telial paraphyses, and in the exposure of the telia. The appended tabulations will have served their purpose if they demonstrate nothing beyond the fact that names exist for just about every possible variant. They also demonstrate that the "complexes" are decidedly unwieldy and indicate the possible need for subspecific taxa based on morphological characters, even if the characters used be only arbitrarily chosen size groups.

Abbreviations Used in Tabulations

h: hyaline
y: yellowish
g: golden-brown
ci: cinnamon-brown
ch: chestnut-brown

nak: naked (telia exposed)
cov: covered (telia under epidermis)
par: paraphyses
ped: pedicel (length)
all measurements are in microns

GENERIC HOST INDEX TO THE GRASS RUSTS OF THE WORLD

Aegilops (Hordeae):
Puccinia aegilopis Maire (=P. recondita)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Aegopogon (Zoysieae):
Puccinia aegopogonis Arth. et Holw. (VI)
Uromyces aegopogonis Diet. et Holw. (VI)
Aeluropus (Festuceae):
Puccinia aeluropodis Ricker (VII)
Puccinia tankuensis Liou et Wang (IX)
Puccinia zoysiae Diet. (Host?) (VI)
Uredo aeluropodina Maire (=Uromyces aeluropodis-repentis)
Uromyces aeluropodinus Tranz. (=U. aeluropodis-repentis)
Uromyces aeluropodis-repentis Nattrass (VII)
Agropyron (Hordeae):
Puccinia actaeae-agropyri E. Fisch. (=P. recondita)
Puccinia agropyri Ell. et Ev. (=P. recondita)
Puccinia agropyri-ciliaris Tai et Wei (VI)
Puccinia agropyricola Hirat. f. (VI)
Puccinia agropyri-junceae Kleb. (=P. recondita)
Puccinia agropyrina Eriks. (=P. recondita)
Puccinia anthistiriae Barclay (=P. graminis)
Puccinia cerinthes-agropyrina Tranz. (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia culmicola Diet. (=P. graminis)
Puccinia dietrichiana Tranz. (=P. recondita)
Puccinia dispersa Eriks. et E. Henn. (=P. recondita)
Puccinia glumarum (Schmidt.) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia hepaticae-agropyri Mayor (=P. recondita)
Puccinia montanensis Ell. (II)
Puccinia pattersoniana Arth. (VI)
Puccinia persistens Plowr. (=P. recondita)
Puccinia rangiferina Ito (=P. coronata)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Puccinia subalpina Lagh. (=P. recondita)
Puccinia thulensis Lagh. (=P. recondita)
Rostrupia miyabeana Ito (=Puccinia agropyricola)
Uromyces agropyri Barclay (VIII)
Uromyces fragilipes Tranz. (VI?)
Agrostis (Agrostideae):
Puccinia agrostidicola Tai (VI)
Puccinia agrostidis Plowr. (=P. recondita)
Puccinia borealis Juel (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)

Puccinia kummerii Gaeum. (=P. poarum?)
Puccinia liatridis Bethel (VI)
Puccinia moyanoi Speg. (VI)
Puccinia poae-nemoralis Otth (II)
Puccinia poarum Niels.? (VI)
Puccinia praegracilis Arth. (VI)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera DC. (=P. recondita)
Puccinia striiformis West. (VI)
Uredo agrostidis Arth. et. Cumm. (II)
Uredo agrostidis-rupestris E. Fisch. (=Puccinia poae-nemoralis)
Uromyces agrostidis (Gonz. Frag.) Guyot (=U. dactylidis)
Uromyces dactylidis Otth (VI)
Uromyces jacksonii Arth. et Fromme (=U. mysticus)
Uromyces mysticus Arth. (VI)
Uromyces poae Rab. (=U. dactylidis)
Uromyces poae Rab. f. agrostidis Gonz. Frag. (=U. dactylidis)

Aira, see Deschampsia

Alopecurus (Agrostideae):
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia lolii Niels. (=coronata)
Puccinia perplexans Plowr. (=P. recondita)
Puccinia poae-nemoralis Otth (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Uromyces alopecuri Seym. (=U. dactylidis)
Uromyces dactylidis Otth (VI)

Ammophila (Agrostideae):
Puccinia ammophilae Guyot (=P. recondita)
Puccinia ammophilina Mains (II)
Puccinia amphigena Diet. (VI)
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers (V)
Puccinia pygmaea Eriks. (II)
Rostrupia ammophilae M. Wils. nom. nud. (=P. recondita?, P. elymi?)
Uredo ammophilae Syd. (=Puccinia recondita?)
Uredo ammophilina Kleb. (=Puccinia ammophilina)

Amphibromus (Aveneae):
Puccinia graminis Pers. (V)

Amphilophis, see Bothriochloa

Andropogon (Andropogoneae): see also Bothriochloa, Capillipedium, Chrysopogon, Cymbopogon, Dichanthium, Hyparrhenia
Phakopsora incompleta (Syd.) Cumm. (II)
Puccinia agrophila Syd. (VI)
Puccinia andropogonicola Hariot et Pat. (I) (Host probably Cymbopogon)
Puccinia andropogonis Schw. (V, VI)
Puccinia coronata Cda. (Host?) (II)
Puccinia citrata Syd. (=P. nakanishikii)
Puccinia duthiae Ell. et Tracy (Host?) (I)
Puccinia ellisiana Thuem. (VII)
Puccinia erianthicola Cumm. (Host?) (V)
Puccinia eritraeensis Paz. (II) (P. erythraeensis)
Puccinia eucomi Doidge (V)
Puccinia graminis Pers. (Host?) (V)
Puccinia incompleta Syd. (=Phakopsora incompleta)

Puccinia jaagi Boed. (on <u>Sorgum</u>)
Puccinia kaernbachii Arth. (=<u>P. posadensis</u>)
Puccinia microspora Diet. (Host?) (I)
Puccinia nakanishikii Diet. (I)
Puccinia posadensis Sacc. et Trott. (I)
Puccinia prunicolor Syd. et Butl. (=<u>P. purpurea</u> on <u>Sorgum</u>)
Puccinia purpurea Cke. (Host?) (II)
Puccinia tripsaci Diet. et Holw. (V)
Puccinia versicolor Diet. et Holw. (VI)
Uredo andropogonis-lepidi P. Henn. (VI)
Uredo andropogonis-zeylandicae Petch (VI)
Uredo geniculata Cumm. (II)
Uredo rubida Arth. et Holw. (=<u>Puccinia erianthicola</u>)
Uredo schizachyrii Doidge (I)
Uredo schoenanthi Syd. (=<u>Uromyces schoenanthi</u>)
Uredo susica Maire (VIII)
Uromyces andropogonis Tracy (VII)
Uromyces andropogonis-annulati Syd. et Butl. (=<u>U. clygnii</u>)
Uromyces clignyi Pat. et Hariot (VI)
Uromyces schoenanthi Syd. (Host?) (V)

<u>Anthistiria</u> (Andropogoneae):
Puccinia anthistiriae Barclay (=<u>P. graminis</u> on <u>Agropyron</u>)
Uredo anthistiriae Petch (VI)
Uredo anthistiriae-tremulae Petch (IV)

<u>Anthephora</u> (Zoysieae):
Puccinia anthephorae Arth. et J.R. Johnston (VII)
Puccinia cenchri Diet. et Holw. (Host?) (V)
Puccinia chaseana Arth. et Fromme (I)

<u>Anthoxanthum</u> (Phalarideae):
Puccinia anthoxanthi Fckl. (=<u>P. graminis</u>)
Puccinia anthoxanthina Gaeum. (=<u>P. poae-nemoralis</u>)
Puccinia borealis Juel (=<u>P. recondita</u>)
Puccinia fujiensis Ito (=<u>P. recondita</u>)
Puccinia graminis Pers. (V)
Puccinia poae-nemoralis Otth (II)
Puccinia poae-sudeticae Joerst. (=<u>P. poae-nemoralis</u>)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia sardonensis Gaeum. (=<u>P. recondita</u>)
Uredo anthoxanthina Bub. (=<u>P. poae-nemoralis</u>)

<u>Apera</u> (Agrostideae):
Puccinia graminis Pers. (V)
Puccinia poae-nemoralis Otth? (II)
Puccinia spicae-venti Bucholtz (Host?) (=<u>P. poae-nemoralis?</u>)

<u>Apluda</u> (Andropogoneae):
Puccinia apludae Syd. (I)
Uredo apludae Barclay (VII)
Uromyces apludae Syd. and Butl. (=<u>U. schoenanthi</u>)
Uromyces inayati Syd. (VII)
Uromyces schoenanthi Syd. (V)

<u>Arctagrostis</u> (Agrostideae):
Puccinia poae-nemoralis Otth (II)
Puccinia pygmaea Eriks. (error for <u>P. poae-nemoralis</u>)

<u>Aristida</u> (Agrostideae):
Puccinia aristidae Tracy (VII)
Puccinia aristidicola P. Henn. (=<u>P. boutelouae</u> on <u>Bouteloua</u>)
Puccinia bottomleyae Doidge (II)
Puccinia eylesii Doidge (II)

Puccinia graminis Pers. (V)
Puccinia subnitens Diet. (=P. aristidae)
Puccinia unica Holw. (I)
Uredo aristidae-acutiflorae Maire (VII)
Uromyces aristidae Ell. et Ev. (II)
Uromyces peckianus Farl. (VIII)
Uromyces setitiosus Kern (=U. peckianus)

Arrhenatherum (Aveneae):
Puccinia arrhenatheri Eriks. (=P. poae-nemoralis)
Puccinia arrhenathericola E. Fisch. (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia graminis Pers. (V)
Puccinia montanensis Ell. (II)
Puccinia poae-nemoralis Otth (II)
Puccinia recondita Rob. ex Desm. (VI)

Arthraxon (Andropogoneae):
Puccinia aestivalis Diet. (Host?) (I)
Puccinia arthraxonis Syd. et Butl. (VI)
Puccinia arthraxonis-ciliaris Cumm. (I)
Uredo arthraxonis-ciliaris P. Henn. (=P. arthraxonis-ciliaris)

Arthrostylidium (Bambuseae):
Uredo ignava Arth. (I)

Arundinaria (Bambuseae):
Puccinia arundinariae Schw. (V)
Puccinia bambusarum Arth. (V)
Puccinia kusanoii Diet. (V)
Puccinia longicornis Hariot et Pat. (I)
Puccinia melanocephala Syd. (I)
Puccinia phyllostachydis Kus. (I)
Stereostratum corticioides (Berk. et Br.) Magn. (V)

Arundinella (Melinideae):
Puccinia arundinellae Barclay (VI)
Puccinia arundinellae-anomalae Diet. (VI)
Puccinia arundinellae-setosae Tai (I)
Puccinia coronata Cda. (II, VI)
Uredo arundinellae Arth. et Holw. (V)
Uredo arundinellae-nepalensis Cumm. (I)
Uredo nakanishikii P. Henn. (V)
Uredo pretoriensis Syd. (=P. arundinellae)
Uredo yoshinagai Diet. (VI)

Arundo (Festuceae):
Puccinia coronata Cda. (error for P. recondita)
Puccinia isiacae Wint. (V)
Puccinia magnusiana Koern. (II)
Puccinia phragmitis Koern. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia torosa Thuem. (V)
Uredo arundinis-donacis Tai (I)
Uredo toetoe Cunn. (VI)

Astrebla (Chlorideae):
Uromyces trichoneurae Doidge (V)

Atropis, see Puccinellia

Axonopus (Paniceae):
Angiopsora compressa (Arth. et Holw.) Mains (II)
Puccinia levis (sacc. et Bizz.) Magn. (V)

<u>Avellinia</u> (Festuceae):
    Puccinia schismi Bub. (VI)
<u>Avena</u> (Aveneae):
    Puccinia avenae-barbatae Gonz. Frag. (=<u>P</u>. <u>coronata</u>)
    Puccinia avenae-pubescentis Bub. (=<u>P</u>. <u>graminis</u> on <u>Anthoxanthum</u>)
    Puccinia avenastri Guyot (=<u>P</u>. <u>sesleriae</u> on <u>Sesleria</u>)
    Puccinia bromoides Guyot (VI)
    Puccinia coronata Cda. (II, VI)
    Puccinia coronifera Kleb. (=<u>P</u>. <u>coronata</u>)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=<u>P</u>. <u>striiformis</u>)
    Puccinia graminis Pers. (V)
    Puccinia lolii Niels. (=<u>P</u>. <u>coronata</u>)
    Puccinia pratensis Blytt (VI)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=<u>P</u>. <u>recondita</u>)
    Puccinia striiformis West.? (VI)
    Puccinia versicoloris Semadeni (VI)
    Uredo avenae-pratensis Eriks. (=<u>P</u>. <u>pratensis</u>)
<u>Bambusa</u> (Bambuseae): (Many host records doubtful)
    Angiopsora divina Syd. (=<u>Dasturella</u> <u>divina</u>)
    Chrysomyxa bambusae Teng (=no rust)
    Dasturella bambusina Mundk. et Kheswalla (I)
    Dasturella divina (Syd.) Mundk. et Kheswalla (I)
    Kweilingia bambusae (Teng) Teng (=no rust)
    Puccinia amianthina Syd. (IX)
    Puccinia corticioides Berk. et Br. (=<u>Stereostratum</u> <u>corticioides</u>)
    Puccinia gracilenta Syd. et Butl. (IX)
    Puccinia kusanoii Diet. (V)
    Puccinia kwanhsiensis Tai (II)
    Puccinia longicornis Pat. et Hariot (I)
    Puccinia melanocephala Syd. (I)
    Puccinia mitriformis Ito (IX)
    Puccinia phyllostachydis Kus. (I)
    Puccinia xanthosperma Syd. (IX)
    Uredo ignava Arth. (I)
<u>Beckeropsis</u>, see <u>Pennisetum</u>
<u>Beckmannia</u> (Agrostideae):
    Puccinia beckmanniae McAlp. (=<u>P</u>. <u>coronata</u>)
    Puccinia coronata Cda. (II, VI)
    Puccinia graminis Pers. (V)
    Uromyces beckmanniae Jacks. (VI)
<u>Bewsia</u> (Festuceae):
    Puccinia bewsiae Cumm. (IX)
<u>Bothriochloa</u> (Andropogoneae):
    Puccinia amphilophidis Doidge (=<u>P</u>. <u>duthiae</u>)
    Puccinia cesatii Schroet. (VII)
    Puccinia duthiae Ell. et Tracy (I)
    Puccinia infuscans Arth. et Holw. (VII)
    Puccinia kenmorensis Cumm. (II)
    Puccinia meridensis Kern (VII)
    Puccinia nakanishikii Diet. (Host?) (I)
    Puccinia propinqua Syd. et Butl. (=<u>P</u>. <u>cesatii</u>)
    Puccinia pseudocesatii Cumm. (VII)
    Puccinia versicolor Diet. et Holw. (VI)
    Uromyces amphilophidis-insculptae T.S. Ramak., Srinivasan et Sundaram (=<u>U</u>. <u>clignyi</u>)

Uromyces andropogonis Tracy (=error for P. meridensis)
Uromyces andropogonis-annulati Syd. et Butl. (=U. clignyi)
Uromyces clignyi Pat. et Hariot (VI)

Bouteloua (Chlorideae):
Puccinia bartholomaei Diet. (=P. chloridis)
Puccinia boutelouae (Jennings) Holw. (VI)
Puccinia cacabata Arth. et Holw. (V)
Puccinia chloridis Speg. (VI)
Puccinia exasperans Holw. (VI)
Puccinia opuntiae Arth. et Holw. (VIII)
Puccinia stakmanii Presley (=P. cacabata)
Puccinia vexans Farl. (VI)
Uredo chardonii Kern (=P. boutelouae)

Brachiaria (Paniceae):
Angiopsora africana Cumm. (I)
Diorchidium brachiariae Wakef. et Hansf. (=Puccinia) (V)
Puccinia nyasalandica Cumm. (VI)
Uromyces leptodermus Syd. (V)

Brachyelytrum (Agrostideae):
Uromyces halstedii De T. (I)

Brachypodium (Festuceae):
Puccinia agropyri Ell. et Ev. (=P. recondita)
Puccinia agropyricola Hirat. f. (VI)
Puccinia baryi (Berk. et Br.) Wint. (=P. brachypodii)
Puccinia brachypodii Otth (II)
Puccinia brachysora Diet. (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia himalayensis (Barclay) Diet. (=P. coronata)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Puccinia subdigitata Arth. et Holw. (=P. coronata)
Rostrupia miyabeana Ito (=P. agropyricola)

Briza (Festuceae):
Puccinia brizae-maximae T.S. Ramak et Sundaram (=P. graminis)
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)

Bromus (Festuceae):
Puccinia alternans Arth. (=P. recondita)
Puccinia brachypus Speg. (=P. recondita)
Puccinia bromicola (Mains) Guyot (=P. recondita)
Puccinia bromi-japonicae Ito (=P. recondita)
Puccinia bromi-maximi Guyot (=P. recondita)
Puccinia bromina Eriks. (=P. recondita)
Puccinia bromi-rupestris Maire (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia cryptica Arth. et Holw. (VI)
Puccinia decolorata Arth. et Holw. (II)

Puccinia elymi West. (=error for P. recondita)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia madritensis Maire (=P. recondita)
Puccinia montanensis Ell. (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Puccinia symphyti-bromorum F. Muell. (=P. recondita)
Puccinia tomipara Trel. (VI)
Uredo auletica Speg. (=P. recondita)
Uredo bromi-pauciflorae Ito (II)
Uromyces bromicola Arth. et Holw. (VI)
Uromyces brominus Gutsevich (VI?)

Buchloe (Chlorideae):
Puccinia graminis Pers. (V)
Puccinia kansensis Ell. et Barth. (VI)

Calamagrostis (Agrostideae):
Puccinia alpinae-coronatae Muehleth. (=P. coronata)
Puccinia borealis Juel (=P. recondita)
Puccinia brevicornis Ito (=P. coronata)
Puccinia coronata Cda. (II, VI)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia epigejos Ito (=P. coronata)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia hierochloae Ito (=P. coronata)
Puccinia ishikawai Ito (=P. pygmaea)
Puccinia pertenuis Ito (=P. coronata)
Puccinia poae-nemoralis Otth (II)
Puccinia poarum Niels. (error for P. poae-nemoralis)
Puccinia pygmaea Eriks. (II)
Puccinia rangiferina Ito (=P. coronata)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia stichosora Diet. (II)
Puccinia striiformis West. (VI)
Uredo paulensis P. Henn. (=P. poae-nemoralis)

Calamovilfa (Agrostideae):
Puccinia amphigena Diet. (VI)
Puccinia graminis Pers. (V)
Puccinia sporoboli Arth. (V)

Capillipedium (Andropogoneae):
Puccinia cesatii Schroet. (VII)
Puccinia erythraeensis Paz. (Host?) (II)
Puccinia miyoshiana Diet. (VII)
Puccinia pusilla Syd. (I)
Puccinia versicolor Diet. et Holw. (VI)

Catabrosa (Festuceae):
Puccinia glumarum (Schmidt) Eriks. et Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia poae-nemoralis Otth (II)
Puccinia striiformis West. (VI)

Cenchrus (Paniceae):
Puccinia cenchri Diet. et Holw. (V)

Puccinia cenchri var. africana Cumm. (V)
Puccinia pseudophakopsora Speg. (not a rust)
Uredo cenchricola P. Henn. (=P. cenchri var. africana)
Uredo cenchrophila Speg. (=P. cenchri)

Centotheca (Festuceae):
Diorchidium levigatum Syd. et Butl. (probably error for P. lophatheri)
Puccinia lophatheri (Syd.) Hirat. (V)

Chaetium (Paniceae):
Puccinia chaetii Kern et Thurston (V)

Chamaeraphis, see Pseudoraphis

Chaetochloa, see Setaria

Chascolytrum (Festuceae):
Uredo chascolytri Diet. et Neger (VIII)

Chimobambusa (Bambuseae):
Stereostratum corticioides (Berk. et Br.) Magn. (V)

Chloridion, see Stereochlaena

Chloris (Chlorideae):
Puccinia cacabata Arth. et Holw. (V)
Puccinia chloridicola P. Henn. (=P. dietelii)
Puccinia chloridina Bacc. (=P. dietelii)
Puccinia chloridis Speg. (VI)
Puccinia chloridis-incompletae T.S. Ramak., Srinivasan et Sundaram (=P. enteropogonis)
Puccinia dietelii Sacc. et Syd. (VI)
Puccinia enteropogonis Syd. (II)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia striiformis West. (VI)
Uredo chloridis-berroi Speg. (=P. cacabata)
Uredo chloridis-polydactylidis Viegas (=P. cacabata)
Uromyces archerianus Arth. et Fromme (VII)
Uromyces chloridis Doidge (=U. archerianus)
Uromyces kenyensis Hennen (VI)

Chrysopogon (Andropogoneae):
Puccinia chrysopogi Barclay (VI)
Puccinia kawandensis Cumm. (V)
Puccinia omnivora Ell. et Ev. (=P. virgata on Sorghastrum)
Puccinia pseudocesatii Cumm. (VII)

Cinna (Agrostideae):
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt.) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)

Cleistogenes, see Molinia

Coix (Tripsaceae):
Puccinia operta Mundk. et Thirum. (I)
Uredo operta Syd. et Butl. (=P. operta)

Coleanthus (Agrostideae):
Puccinia graminis Pers. (V)
Uredo coleanthi Hariot (=P. graminis)

Colpodium (Festuceae):
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)

Corynephorus (Aveneae):
Puccinia graminis Pers. (V)
Ctenium (Chlorideae):
Puccinia campulosae Theum. (doubtful record)
Uredo ctenii Wakef. et Hansf. (nomen nudum)
Cymbopogon (Andropogoneae):
Puccinia andropogonicola Hariot et Pat. (I)
Puccinia citrata Syd. (=P. nakanishikii)
Puccinia cymbopogonis Mass. (VII)
Puccinia eritraeensis Paz.(Host?) (II) (P. erythraeensis)
Puccinia kaernbachii Arth. (uncertain identity)
Puccinia nakanishikii Diet. (I)
Puccinia purpurea Cke. (Host?) (II)
Puccinia versicolor Diet. et Holw. (VI)
Uredo cymbopogonis-polyneuri Petch (I)
Uredo schoenanthi P. Henn. (=Uromyces schoenanthi)
Uromyces clignyi Pat. et Hariot (VI)
Uromyces schoenanthi Syd. (V)
Cynodon (Chlorideae):
Puccinia coronata Cda. (Host?) (II, VI)
Puccinia cynodontis Desm. (VII)
Puccinia desmazieresii Const. (=P. moliniae?) (Host is probably Cleistogenes-Molinia)
Puccinia graminis Pers. (V)
Puccinia varians Diet. (=P. cynodontis)
Uredo cynodontis-dactylis Tai (I)
Cynosurus (Festuceae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)
Uromyces dactylidis Otth (VI)
Uromyces phyllachoroides P. Henn. (=U. dactylidis)
Cypholepis (Festuceae):
Uromyces eragrostidis Tracy (VI)
Cyrtococcum (Paniceae):
Angiopsora clemensiae Arth. et Cumm. (II)
Puccinia taiwaniana Hirat. et Hash. (V)
Uromyces leptodermus Syd. (V)
Dactylis (Festuceae):
Puccinia coronata Cda. (II, VI)
Puccinia dactylidina Bub. (=P. recondita)
Puccinia dactylidis Gaeum. (=P. graminis)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Uromyces dactylidis Otth (VI)
Dactyloctenium (Chlorideae):
Puccinia dactyloctenii Pat. et Hariot (=P. dietelii)
Puccinia dietelii Sacc. et Syd. (VI)
Uredo dactyloctenii Speg. (=Uromyces dactyloctenii)
Uromyces dactyloctinii Wakef. et Hansf. (V)
Uromyces dactylocteniicola Lindq. (=U. dactyloctenii)
Danthonia (Aveneae):
Puccinia graminis Pers. (V)
Uredo danthoniae P. Henn. (VIII)
Uromyces danthoniae McAlp. (VI)

Dendrocalamus (Bambuseae):
Angiopsora divina Syd. (=Dasturella divina)
Dasturella divina (Syd.) Mundk. et Kheswalla (I)
Uredo dendrocalami Petch (II)
Uredo ignava Arth. (I)

Deschampsia (Aveneae):
Puccinia airae Cruch. et Mayor (=P. deschampsiae)
Puccinia borealis Juel (=P. recondita)
Puccinia connersii Savile (=P. praegracilis)
Puccinia coronata Corda (II, VI)
Puccinia deschampsiae Arth. (II)
Puccinia graminis Pers. (V)
Puccinia poae-sudeticae var. airae (Cruch. et Mayor) Arth. (=P. deschampsiae)
Puccinia poarum Niels. (=error for P. deschampsiae)
Puccinia praegracilis Arth. (VI)
Puccinia recondita Rob. ex Desm. (VI)
Uredo airae Lagh. (=P. deschampsiae)
Uredo airae-flexuosae Liro (=Uromyces dactylidis)
Uromyces airae-flexuosae Ferd. et Winge (=U. dactylidis)
Uromyces dactylidis Otth (VI)
Uromyces jacksonii Arth et Fromme (=U. mysticus)
Uromyces mysticus Arth (VI)

Deyeuxia (Agrostideae): sect. of Calamagrostis
Puccinia agrostidis Plowr. (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia deyeuxiae Tai et Cheo (=P. coronata)
Puccinia elymi West. (=error for P. recondita)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rangiferina Ito (=P. coronata)
Puccinia rubigo-vera Wint. (=P. recondita)

Diarrhena (Festuceae):
Puccinia diarrhenae Miy. et Ito (VI)
Puccinia graminis Pers. (V)

Dichanthium (Andropogoneae):
Puccinia cesatii Schroet. (VII)
Puccinia duthiae Ell. et Tracy (I)
Uredo susica Maire (VIII)
Uromyces andropogonis-annulati Syd. et Butl. (=U. clignyi)
Uromyces clignyi Pat. et Hariot (VI)

Dichelachne (Agrostideae):
Puccinia graminis Pers. (V)
Uredo crinitae Cunn. (II)

Digitaria (Paniceae):
Angiopsora digitariae Cumm. (II)
Melampsora syntherismae Saw. (=Angiopsora digitariae)
Puccinia digitariae P. Evans (=P. oahuensis)
Puccinia digitariae-velutinae Viennot-Bourgin (II)
Puccinia kimurae Hirat. (=P. levis)
Puccinia levis (Sacc. et Bizz.) Magn. (V)
Puccinia oahuensis Ell. et Ev. (I)
Uredo digitariae-ciliaris Mayor (=P. oahuensis)
Uredo digitariaecola Thuem. (=P. oahuensis)
Uredo paspali-longiflorae Petch (Host?) (VI)
Uredo syntherismae (=P. oahuensis)
Uredo tacita Arth. (VI)

Uromyces panici-sanguinalis Rangel (=P. levis)
Uromyces pegleriae P. Evans (VI)

Dimeria (Andropogoneae):
Phakopsora incompleta (Syd.) Cumm. (II)

Diplachne (Festuceae): see also Molinia
Puccinia autralis Koern. (VI)
Puccinia diplachnicola Diet. (VI)
Puccinia moliniae Tul. (V)
Puccinia permixta Syd. (VI)

Distichlis (Festuceae):
Puccinia aristidae Tracy (VII, VIII)
Puccinia subnitens Diet. (=P. aristidae?)
Puccinia thalassica Speg. (=P. aristidae?)
Uromyces peckianus Farl. (VIII)

Eatonia, see Sphenopholis

Eccoilopus (Andropogoneae):
Puccinia miyoshiana Diet. (VII)

Echinochloa (Paniceae):
Puccinia abnormis P. Henn. (=P. flaccida)
Puccinia flaccida Berk. et Br. (VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia striiformis West. (Host?) (VI)
Puccinia subdiorchidioides Speg. (=P. flaccida)
Puccinia vilis Arth. (=P. graminis)

Echinopogon (Agrostideae):
Puccinia graminis Pers. (V)

Ehrharta (Phalarideae):
Uredo ehrhartae-calycinae Doidge (VI)
Uromyces ehrhartae McAlp. (VI)
Uromyces ehrhartae-giganteae Doidge (IX)

Eleusine (Chlorideae):
Uredo eleusines-indicae Saw. (=P. cynodontis on Cynodon)

Elymus (Hordeae):
Puccinia actaeae-elymi Mayor (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia elymi West. (VI)
Puccinia elymicola Const. (=P. recondita)
Puccinia elymina Miura (=P. graminis)
Puccinia elymi-sibiricae Ito (=P. recondita)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia hepaticae-elymi Mayor (=P. recondita)
Puccinia impatientis Arth. (=P. recondita)
Puccinia montanensis Ell. (II)
Puccinia pattersoniana Arth. (VI)
Puccinia procera Diet. et Holw. (=P. recondita)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Puccinia triarticulata Berk. et Curt. (=P. elymi)
Rostrupia elymi (West.) Lagh. (=P. elymi)
Rostrupia elymi-sabulosi O. Savu. et T. Savu. (=P. elymi)
Uredo elymi capitis-medusae Gonz. Frag. (=P. glumarum?)

Enteropogon (Chlorideae):
Puccinia enteropogonis Syd. (II)
Uromyces archerianus Arth. et Fromme (VII)

<u>Entolasia</u> (Paniceae):
  Puccinia levis (Sacc. et Bizz.) Magn. (V)
<u>Epicampes</u>, see <u>Muhlenbergia</u>
<u>Eragrostis</u> (Festuceae):
  Angiopsora hiratsukae Syd. (II)
  Puccinia emaculata Schw.? (=<u>P.</u> <u>eragrostidis-ferrugineae</u>?)
  Puccinia eragrostidicola Kern, Thurston et Whet. (II)
  Puccinia eragrostidis Petch (VI)
  Puccinia eragrostidis-arundinaceae Tranz. et Eremeeva (VII)
  Puccinia eragrostidis-chalcanthae Doidge (=<u>P.</u> <u>pogonarthriae</u>)
  Puccinia eragrostidis-ferrugineae Tai (VI)
  Puccinia eragrostidis-superbae Doidge (I)
  Puccinia morigera Cumm. (VIII)
  Puccinia pogonarthriae Hopk. (VI)
  Uredo kigesiensis Cumm. (VI)
  Uromyces eragrostidis Tracy (VI)
  Uromyces pedicellata P. Evans (=<u>U.</u> <u>eragrostidis</u>)
<u>Eremopogon</u> (Andropogoneae):
  Uromyces clignyi Pat. et Hariot (VI)
<u>Erianthus</u> (Andropogoneae):
  Puccinia daniloi Bub. (VII)
  Puccinia erianthi Padw. et Khan (I)
  Puccinia erianthicola Cumm. (V)
  Puccinia erythropus Diet. (Host?) (V)
  Puccinia eulaliae Barclay (=<u>P.</u> <u>erianthi</u>)
  Puccinia microspora Diet. (I)
  Puccinia polysora Underw. (Host?) (V)
  Puccinia purpurea Cke. (Host?) (II)
  Puccinia virgata Ell. et Ev. (I)
  Uredo fragosoana Cab. (=<u>U.</u> <u>ravennae</u>)
  Uredo ravennae Maire (V)
<u>Eriochloa</u> (Paniceae):
  Uredo eriochloana Sacc. et Trott. (=<u>Uromyces</u> <u>leptodermus</u>)
  Uromyces eriochloae Syd. et Butl. (=<u>U.</u> <u>leptodermus</u>)
  Uromyces leptodermus Syd. (V)
<u>Euchlaena</u> (Tripsaceae):
  Angiopsora pallescens (Arth.) Mains (VI)
  Puccinia pallescens Arth. (=<u>Angiopsora</u> <u>pallescens</u>)
  Puccinia polysora Underw. (V)
  Puccinia sorghi Schw. (V)
<u>Eulalia</u> (Andropogoneae):
  Phakopsora incompleta (Syd.) Cumm. (II)
  Puccinia phaeopoda Syd. (IX)
  Puccinia polliniae-quadrinervis Diet. (VIII)
  Uredo eulaliae-fulvae Cumm. (I)
  Uredo morobeana Cumm. (V)
  Uredo polliniae-imberbis Ito (=<u>Phakopsora</u> <u>incompleta</u>)
  Uromyces apludae Syd. et Butl. (V)
  Uromyces polytriadicola Arth. et Cumm. (=<u>U.</u> <u>schoenanthi</u>)
  Uromyces schoenanthi Syd. (V)
<u>Exotheca</u> (Andropogoneae):
  Phakopsora incompleta (Syd.) Cumm. (II)
  Uredo exothecae Wakef. et Hansf. (<u>nomen</u> <u>nudum</u>)
  Uromyces clignyi Pat. et Hariot (VI)
<u>Festuca</u> (Festuceae):
  Puccinia aconiti-rubrae Ludi (=<u>P.</u> <u>recondita</u>)

Puccinia cockerelliana Bethel (=P. recondita)
Puccinia corniculata Mayor et Viennot-Bourgin (=P. coronata)
Puccinia coronata Cda. (II, VI)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia crandallii Pam. et Hume (VI)
Puccinia festucae Plowr. (VI)
Puccinia festucae-ovinae Tai (IX)
Puccinia festucina Syd. (=P. sessilis?)
Puccinia gibberosa Lagh. (=P. coronata)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia himalayensis (Barcl.) Diet. (=P. coronata)
Puccinia mellea Diet. et Neger (=P. recondita)
Puccinia petasiti-pulchellae Ludi (=P. poarum)
Puccinia piperii Ricker (VI)
Puccinia poae-nemoralis Otth (II)
Puccinia poarum Niels. (VI)
Puccinia pseudomyuri Kleb. (=P. schismi?)
Puccinia pygmaea Eriks. (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia sessilis Schneid. (VI)
Puccinia schismi Bub. (VI)
Puccinia scillae-rubri Ludi (VI)
Puccinia smilacearum-festucae Mayor (=P. sessilis)
Puccinia striiformis West. (VI)
Puccinia vulpiae-myuri Mayor et Viennot-Bourgin (=P. schismi)
Puccinia vulpiana Guyot (=P. schismi)
Uredo festucae DC. (=P. festucae?)
Uredo festucae-hallerii Cruch. (=P. poae-nemoralis)
Uredo festucae-ovinae Eriks. (=Uromyces dactylidis)
Uredo kergulensis P. Henn. (IV)
Uromyces cuspidatus Wint. (IX)
Uromyces dactylidis Otth (VI)
Uromyces festucae Syd. (=U. dactylidis)
Uromyces festucae-nigricantis Gonz. Frag. (=U. dactylidis)
Uromyces fuegianus Speg. (VI)
Uromyces hordeinus (Arth.) Arth. (VI)
Uromyces jacksonii Arth. et Fromme (=U. mysticus)
Uromyces mysticus Arth. (VI)
Uromyces ranunculi-festucae Jaap (=U. dactylidis)
Uromyces vulpiae Camara (=U. dactylidis)
Uromyces vulpiae Losa Espana (=U. dactylidis)

Fluminea, see Scolochloa

Garnotia (Agrostideae):
Puccinia garnotiae T.S. Ramak. et Sundaram (VI?)

Gastridium (Agrostideae):
Puccinia graminis Pers. (V)

Gaudinia (Aveneae):
Puccinia gaudineana Guyot (=P. schismi)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia schismi Bub. (VI)

Glyceria (Festuceae):
Puccinia coronata Cda. (II, VI)

Puccinia coronifera Kleb. (=P coronata)
Puccinia glyceriae Ito (=P. recondita)
Puccinia graminis Pers. (V)
Puccinia paniculariae Arth. (P. coronata)
Puccinia poae-nemoralis Otth (II)
Puccinia recondita Rob. ex Deam. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Uredo glyceriae Lind (=P. poae-nemoralis)
Uredo glyceriae Opiz (=no rust)
Uredo glyceriae-distantis Eriks. (=P. poae-nemoralis)
Uromyces amphidymus Syd. (VI)
Uromyces glyceriae Arth. (=U. amphidymus)

Gouinia (Chlorideae):
Puccinia chichinensis Mains (=P. guaranitica)
Puccinia guaranitica Speg. (VI)

Gymnopogon (Chlorideae):
Puccinia boutelouae (Jennings) Holw. (VI)
Puccinia gymnopogonis Syd. (=P. boutelouae)
Puccinia gymnopogonicola Hennen (VI)

Gymnothrix, see Pennisetum

Hackelochloa (Andropogoneae):
Puccinia cacao McAlp. (I)
Puccinia levis (Sacc. et Bizz.) Magn. (host is Manisurus)
Puccinia pappiana Syd. (I)

Haynaldia (Hordeae):
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia haynaldiae Mayor et Viennot-Bourgin (=P. recondita)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)

Helictotrichum (Aveneae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)

Hemarthria (Andropogoneae):
Puccinia cacao McAlp. (I)
Puccinia microspora Diet. (I)
Puccinia rottboelliae Syd. (Host?) (V)
Uredo mira Cumm. (=P. cacao)
Uredo rottboelliae Diet. (=P. cacao)
Uromyces andropogonis-annulati Syd. et Butl. (=U. clignyi)
Uromyces clignyi Pat. et Hariot (VI)

Hesperochloa (Festuceae):
Puccinia crandallii Pam. et Hume (VI)

Heteranthelium (Hordeae):
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia lineatula Bub. (=P. striiformis)
Puccinia striiformis West. (VI)

Heteropogon (Andropogoneae):
Puccinia cesatii Schroet. (f. heteropogonis Beltr. (VII)
Puccinia filipodia Cumm. (=P. versicolor)
Puccinia versicolor Diet. et Holw. (VI)

Hierochloa (Phalarideae):
Puccinia borealis Juel. (=P. recondita)
Puccinia coronata Cda. (II, VI)

Puccinia graminis Pers. (V)
Puccinia hierochloae Ito (=P. coronata)
Puccinia hierochloina Kleb. (=P. recondita)
Puccinia recondita Rob. ex Desm. (VI)
Uredo karetu Cunn. (IV)

Hilaria (Zoysieae):
Puccinia aristidae Tracy (VII, VIII)

Holcus (Aveneae):
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia coronifera Kleb. (=P. coronata)
Puccinia graminis Pers. (V)
Puccinia holcicola Guyot (=P. recondita)
Puccinia holcina Eriks. (=P. recondita)
Puccinia nakanishikii Diet. (Host?) (I)
Puccinia purpurea Cke. (Host?) (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)

Hordeum (Hordeae):
Puccinia acteae-elymi Mayor (=P. recondita)
Puccinia anomala Rostr. (=P. hordei)
Puccinia brachypus Speg. (=P. recondita)
Puccinia coronata Cda. (II, VI)
Puccinia cryptica Arth. et Holw. (Doubtful identity) (VI)
Puccinia glumarum (Schmidt) Eriks. et Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia hordei Otth (VI)
Puccinia hordei Fckl. (=P. recondita)
Puccinia hordei-maritimi Guyot (=P. recondita)
Puccinia hordei-murini Buchw. (=P. recondita)
Puccinia hordeina Lavrov (VI)
Puccinia hordei-secalini Viennot-Bourgin (=P. recondita)
Puccinia lineatula Bub. (=P. striiformis)
Puccinia montanensis Ell. (II)
Puccinia poae-nemoralis Otth (II)
Puccinia pygmaea Eriks. (error for P. poae-nemoralis)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia simplex (Koern.) Eriks. et E. Henn. (=P. hordei)
Puccinia striiformis West. (VI)
Puccinia tornata Arth. et Holw. (VI)
Uromyces hordeastri Guyot (=U. musticus)
Uromyces hordei Tracy (=U. hordeinus)
Uromyces hordeinus (Arth.) Arth. (VI)
Uromyces jacksonii Arth. et Fromme (=U. mysticus)
Uromyces mysticus Arth. (VI)
Uromyces turcomanicum Katajev (VI)

Hyparrhenia (Andropogoneae):
Puccinia andropogonicola Hariot et Pat. (I)
Puccinia andropogonis-hirti Beltr. (II)
Puccinia eritraeensis Paz. (II) (P. erythraeensis)
Puccinia hyparrheniae Cumm. (V)

Puccinia hyparrheniicola Joerst. et Cumm. (II)
Puccinia kaernbachii Arth. (=P. posadensis)
Puccinia posadensis Sacc. et Trott. (Host?) (I)
Puccinia rottboelliae Syd. (Host?) (V)
Puccinia versicolor Diet. et Holw. (VI)
Uromyces clignyi Hariot et Pat. (VI)

Hystrix (Hordeae):
Puccinia apocrypta Ell. et Tracy (=P. recondita)
Puccinia asperellae-japonicae Hara (IX)
Puccinia coronata Cda. (II, VI)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia kiusiana Hirat. (V)
Puccinia montanensis Ell. (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)

Ichnanthus (Paniceae):
Puccinia ichnanthi Mains (V)
Puccinia inclita Arth. (V)

Imperata (Andropogoneae):
Puccinia fragosoana Beltr. (I)
Puccinia imperatae Beltr. (=P. imperatae)
Puccinia imperatae Doidge (=P. imperatae)
Puccinia imperatae Poirault (V)
Puccinia kaernbachii Arth. (error for P. microspora)
Puccinia microspora Diet. (I)
Puccinia miscanthi Miura (Host?) (I)
Puccinia rufipes Diet. (I)
Uredo imperatae Magn. (=P. imperatae)

Isachne (Paniceae):
Puccinia isachnes Petch (I)
Puccinia kunthiana T.S. Ramak., Srinivasan et Sundaram (=P. isachnes)
Puccinia sublesta Cumm. (I)
Uredo isachnes Saw. (VII)
Uredo martynii Dale (VI?)
Uromyces isachnes Petch (=P. isachnes)

Ischaemum (Andropogoneae):
Melampsora syntherismae Saw. p.p. (=Phakopsora incompleta)
Phakopsora incompleta (Syd.) Cumm. (II)
Puccinia citrata Syd. (=P. nakanishikii) (Host?)
Puccinia incompleta Syd. (=Phakopsora incompleta)
Puccinia ischaemi Diet. (=P. zoysiae on Zoysia)
Puccinia versicolor Diet. et Holw. (VI)
Uredo ischaemi Syd. et Butl. (VI)
Uredo ischaemi-ciliaris Petch (II)
Uredo ischaemi-commutati Petch (=U. ischaemi-ciliaris)
Uromyces leptodermus Syd. (Host?) (V)

Ischurochloa (Bambuseae):
Dasturella divina (Syd.) Mundk. et Kheswalla (I)

Ixophorus (Paniceae):
Uromyces puttemansii Rangel? (I)

Koeleria (Aveneae):
Puccinia conspicua Mains (VI)
Puccinia coronata Cda. (II, VI)

Puccinia fragosoii Bub. (=*P. schismi*)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=*P. striiformis*)
Puccinia graminis Pers. (V)
Puccinia koeleriae Arth. (II)
Puccinia koeleriae Politis (=*P. schismi*)
Puccinia koeleriicola Tranz. (VI)
Puccinia liatridis Bethel (VI)
Puccinia longissima Schroet. (VI)
Puccinia monoica Arth. (VI)
Puccinia paliformis Fckl. (Host?-maybe *Carex*)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=*P. recondita*)
Puccinia scarlensis Gaeum. (=*P. recondita*)
Puccinia schismi Bub. (VI)
Puccinia striiformis West. (VI)
Puccinia thalictri-koeleriae Gaeum. (=*P. recondita*)
Puccinia stipae Arth. (VI)

Lagurus (Agrostideae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis (V)
Puccinia laguri Jaap (=*P. schismi*)
Puccinia laguri-chamaemoly Maire (=*P. schismi*)
Puccinia schismi Bub. (VI)

Lamarckia (Festuceae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)
Puccinia poae-nemoralis Otth (II)
Uredo lamarckiae Kleb. (=*P. poae-nemoralis*)
Uredo lamarckiae Cab. et Gonz-Frag. (=*P. poae-nemoralis*)

Lasiagrostis, see *Stipa*

Lasiacis (Paniceae):
Angiopsora lenticularis Mains (VI)
Puccinia lasiacidis Kern (V)
Uromyces costaricensis Syd. (V)

Leersia (Oryzeae):
Puccinia ekmanii Kern, Cif., et Thurston (I)
Puccinia fushunensis Hara (IX)
Puccinia graminis Pers. (V)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=*P. recondita*)
Uromyces halstedii De T. (I)

Leleba (Bambuseae):
Dasturella divinia (Syd.) Mundk. et Kheswalla (I)
Stereostratum corticioides (Berk. et Br.) Magn. (V)

Leptochloa (Chlorideae):
Puccinia bartholomaei Diet. (=*P. chloridis*)
Puccinia chloridis Speg. (VI)
Puccinia leptochloae Arth. et Fromme (VIII)
Puccinia subtilipes Speg. (VI)
Uromyces archerianus Arth. et Fromme (VII)
Uromyces leptochloae Wakef. (VI)

Leptoloma (Paniceae):
Puccinia atra Diet. et Holw. (VII)
Puccinia imposita Arth. (V)

<u>Lepturus</u> (Hordeae):
    Puccinia lepturi Hirat. (VI)
<u>Limnodea</u> (Agrostideae):
    Puccinia coronata Cda. (II, VI)
    Puccinia graminis Pers. (V)
    Puccinia schedonnardi Kell. et Swing. (VI)
<u>Lolium</u> (Hordeae):
    Puccinia brachypus Speg. (var. <u>loliiphila</u> Speg.) (=<u>P</u>. <u>schismi</u>)
    Puccinia coronata Cda. (II, VI)
    Puccinia coronifera Kleb. (=<u>P</u>. <u>coronata</u>)
    Puccinia cryptica Arth.and Holw. (=error)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=<u>P</u>. <u>striiformis</u>)
    Puccinia graminis Pers. (V)
    Puccinia lolii Niels. (=<u>P</u>. <u>coronata</u>)
    Puccinia loliicola Viennot-Bourgin (=<u>P</u>. <u>schismi</u>)
    Puccinia loliina Syd. (=<u>P</u>. <u>schismi</u>)
    Puccinia montanensis Ell. (II)
    Puccinia poae-nemoralis Otth (II)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia schismi Bub. (VI)
    Puccinia striiformis West. (VI)
<u>Lophatherum</u> (Festuceae):
    Puccinia lophatheri (Syd.) Hirat. (V)
    Uredo lophatheri Petch (IX)
<u>Loudetia</u> (Aveneae)
    Phakopsora loudetiae Cumm. (II)
    Puccinia loudetiae Wakef. et Hansf. (I)
    Puccinia loudetiae-superbae Cumm. (I)
<u>Lycurus</u> (Agrostideae):
    Puccinia schedonnardi Kell. et Swing. (VI)
<u>Lygeum</u> (Oryzeae):
    Uromyces lygei Syd. (=<u>U</u>. <u>dactylidis</u>)
    Uromyces dactylidis Otth (VI)
<u>Manisuris</u> (Paniceae)
    Puccinia levis (Sacc. et Bizz.) Magn. (V)
<u>Melica</u> (Festuceae):
    Puccinia coronata Cda. (II, VI)
    Puccinia erikssoni Bub. (=<u>P</u>. <u>coronata</u>)
    Puccinia graminis Pers. (V)
    Puccinia heimerliana Bub. (VI?)
    Puccinia melicae (Eriks.) Syd. (=<u>P</u>. <u>coronata</u>)
    Puccinia melicina Arth. and Holw. (VI)
    Puccinia montanensis Ell. (error for <u>P</u>. <u>poae-nemoralis</u>)
    Puccinia paradoxica Ricker (II)
    Puccinia petasiti-melicae Gaeum. (=<u>P</u>. <u>poarum</u>)
    Puccinia poae-nemoralis Otth (II)
    Puccinia poarum Niels. (VI)
    Puccinia pygmaea Eriks. (error for <u>P</u>. <u>poae-nemoralis</u>)
    Puccinia rangiferina Ito (=<u>P</u>. <u>coronata</u>)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=<u>P</u>. <u>recondita</u>)
    Puccinia schedonnardi Kell. et Swing. (VI)
    Puccinia treбouii Syd. (=<u>P</u>. <u>heimerliana</u>)
    Uredo jozankensis Ito (=<u>Puccinia</u> <u>coronata</u>)

Uromyces cuspidatus Wint. (=error for _U. graminis_)
Uromyces graminis (Niessl) Diet. (VI)
Uromyces graminis-ferulae Maire (=_U. graminis_)
Uromyces punicus Maire (=_U. graminis_)

Melinis (Melinideae):
Angiopsora hansfordii Cumm. (II)
Uredo melindis Kern (=_U. leptodermus_)
Uromyces leptodermus Syd. (V)

Microchloa (Chlorideae):
Uromyces microchloae Syd. (V)

Microlaena (Phalarideae):
Uromyces ehrhartae McAlp. (VI)

Microstegium (Andropogoneae):
Phakopsora incompleta (Syd.) Cumm. (II)
Puccinia aestivalis Diet. (I)
Puccinia benguetensis Syd. (I)
Puccinia microstegii Saw. (=_P. polliniae-imberbis_)
Puccinia polliniae Barclay (I)
Puccinia polliniae-imberbis Hirat. (I)
Puccinia polliniicola Syd. (V)
Uredo ogaoensis Cumm. (=_P. aestivalis_)
Uredo polliniae-imberbis Ito (=_Phakopsora incompleta_)

Milium (Agrostideae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)
Puccinia milii Eriks. (=_P. poae-nemoralis_)
Puccinia milii-effusi Dupais (=_P. recondita_)
Puccinia poae-nemoralis Otth (II)
Puccinia pygmaea Eriks. (error for _P. poae-nemoralis_)
Puccinia recondita Rob. ex Desm. (VI)
Uromyces adelphicus Syd. (=_U. dactylidis_)
Uromyces dactylidis Otth (VI)

Miscanthidium, see _Miscanthus_

Miscanthus (Andropogoneae):
Puccinia daisenensis Hirat. (I)
Puccinia erythropus Diet. (V)
Puccinia eulaliae Auth. not Barclay (=_P. miscanthi_)
Puccinia miscanthi Miura (I)
Puccinia miscanthicola Tai et Cheo (IX)
Puccinia miscanthicola Tranz. (=_P. miscanthi_)
Puccinia miscanthidii Doidge (V)
Uredo miscanthi-sinensis Saw. (IV)

Molinia (Festuceae):
Puccinia australis Koern. (VI)
Puccinia brunellarum-moliniae Cruch. (=_P. moliniae_)
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)
Puccinia moliniae Tul. (V)
Puccinia nemoralis Juel (=_P. moliniae_)
Puccinia moliniicola Cumm. (VI)

Moliniopsis (Festuceae):
Puccinia ishikariensis Ito (=_P. recondita_)
Puccinia moliniae Tul. (V)
Puccinia recondita Rob. ex Desm. (VI)

Monanthochloa (Festuceae):
    Puccinia schedonnardi Kell. et Swing. (VI)
Monocymbium (Andropogoneae):
    Puccinia versicolor Diet. et Holw. (VI)
    Uromyces clignyi Pat. et Har. (VI)
Muhlenbergia (Agrostideae):
    Puccinia dochmia Berk. et Curt. (VI)
    Puccinia epicampis Arth. (VI)
    Puccinia graminis Pers. (V)
    Puccinia luxuriosa Syd. (VI)
    Puccinia muhlenbergiae Arth. et Holw. (=P. schedonnardi)
    Puccinia schedonnardi Kellerm. et Swing. (VI)
    Puccinia sinica Syd. (VI)
    Uromyces cuspidatus Wint. (error for U. graminis)
    Uromyces epicampis Diet. et Holw. (VI)
    Uromyces graminis (Niessl) Diet. (VI)
    Uromyces ignobilis Arth. (error for U. major)
    Uromyces major Arth. (V)
    Uromyces minimus J.J. Davis (VI)
    Uromyces muhlenbergiae Ito (V)
Nardurus (Festuceae):
    Puccinia narduri Gonz. Frag. (=P. recondita)
    Puccinia recondita Rob. ex Desm. (VI)
Nasella (Agrostideae):
    Puccinia digna Arth. et Holw. (II)
    Puccinia graminella Diet. et Holw. (IX)
    Puccinia interveniens Bethel (IX)
    Puccinia nasellae Arth. et Holw. (II)
    Uromyces nasellae Cumm. (VI)
    Uromyces pencanus Arth. et Holw. (VI)
Neyraudia (Festuceae):
    Puccinia neyraudiae Syd. (IX)
Ochlandia (Bambuseae):
    Uredo ochlandiae Petch (II)
Olyra (Paniceae):
    Angiopsora phakopsoroides (Arth. et Mains) Mains (II)
    Puccinia bambusarum Arth. (V)
    Puccinia belizensis Mains (V)
    Puccinia deformata Berk. et Curt. (V)
    Puccinia faceta Syd. (V)
    Puccinia olyrae-latifoliae Viennot-Bourgin (V)
    Puccinia phakopsoroides Arth. et Mains (=Angiopsora phakopsoroides)
    Uredo detenta Mains (V)
Ophiurus (Andropogoneae):
    Uredo ophiuri Syd. et Butl. (I)
Oplismenus (Paniceae):
    Diorchidium levigatum Syd. et Butl. (=P. levigata)
    Phakopsora oplismeni Cumm. (II)
    Puccinia Advena Syd. (V)
    Puccinia inclita Arth. (V)
    Puccinia levigata (Syd. et Butl.) Hirat. (V)
    Puccinia levis (Sacc. et Bizz.) Magn. (V)
    Puccinia opipara Cumm. (V)
    Puccinia oplismeni Syd. (IX)

Uredo oplismeni Arth. et Cumm. (=Phakopsora oplismeni)
Uredo paspalicola P. Henn. (error for P. inclita)

Oryza (Oryzeae):
Puccinia graminis Pers. (V)
Uromyces coronatus Miy. et Nish. (Host?) (I)

Oryzopsis (Agrostideae):
Puccinia burnettii Griff. (V)
Puccinia coronata Cda. (II, VI)
Puccinia himalayensis (Barclay) Diet. (=P. coronata)
Puccinia micrantha Griff. (VI)
Puccinia oryzopsidis Syd. et Butl. (VI)
Puccinia piptatheri Lagerh. (VI)
Puccinia pygmaea Eriks.? (II)
Puccinia scaber (Ell. et Ev.) Barth. (=P. substerilis)
Puccinia stipae Arth. (VI)
Puccinia substerilis Ell. et Ev. (VI)

Ottochloa (Paniceae):
Angiopsora clemensiae Arth. et Cumm. (II)

Panicum (Paniceae):
Angiopsora aurea Cumm. (VI)
Angiopsora clemensiae Arth. et Cumm. (II)
Angiopsora lenticularis Mains (VI)
Diorchidium orientale Syd. et Butl. (=P. orientalis)
Puccinia atra Diet Holw. (VII)
Puccinia circumdata Mains. (I)
Puccinia coronata Cda. (Host?) (II, VI)
Puccinia emaculata Schw. (V)
Puccinia esclavensis Diet. et Holw. (=P. atra)
Puccinia flaccida Berk. et Br. (VI)
Puccinia goyazensis (P. Henn.) Syd. (=P. levis)
Puccinia graminis Pers. (V)
Puccinia huberii P. Henn. (V)
Puccinia insolita Syd. (V)
Puccinia levis (Sacc. et Bizz.) Magn. (V)
Puccinia millegranae Cumm. (V)
Puccinia negrensis P. Henn. (V)
Puccinia nyasaensis Cumm. (V)
Puccinia oahuensis Ell. and Ev. (Host?) (I)
Puccinia orientalis (Syd. et Butl.) Arth. et Cumm. (V)
Puccinia pangasinensis Syd. (non-valid; =P. taiwaniana?)
Puccinia panici Diet. (V)
Puccinia panici-montani Fujikuro (IX)
Puccinia panicophila Speg. (=P. atra on Trichachne)
Puccinia praecellens Syd. (=P. subcentripora)
Puccinia puttemansii P. Henn. (V)
Puccinia subcentripora Arth. et Cumm. (V)
Puccinia substriata Ell. et Barth. (V)
Puccinia taiwaniana Hirat. et Hash. (V)
Puccinia vilis Arth. (=P. graminis on Echinochloa)
Triphragmium graminicola Beeli (=a diorchidioid Puccinia) (V)
Uredo duplicate Rangel (=P. oahuensis on Digitaria)
Uredo henningsii Sacc. et Sacc. (V)
Uredo panici-maximi Rangel (=Uromyces leptodermus)
Uredo panici-montani Petch (V)

Uredo panicophila Speg. (=*Puccinia atra?*)
Uredo panici-plicati Saw. (V)
Uredo panici-urvilleana Diet. et Neg. (V)
Uredo panici-villosi Petch (IX)
Uredo rubigo-vera DC. (Host?)
Uredo syntherismae Speg. (=*Puccinia oahuensis* on *Digitaria*)
Uredo uromycoides Speg. (IX)
Uromyces costaricensis Syd. (Host?) (V)
Uromyces graminicola Burr. (V)
Uromyces leptodermys Syd. (V)
Uromyces linearis Berk. et Br. (V)
Uromyces niteroyensis Rangel (=*U. puttemansii*)
Uromyces panici Tracy (=*U. graminicola*)
Uromyces panici-sanguinalis Rangel (=*Puccinia levis*)
Uromyces puttemansii Rangel (I)
Uromyces sepultus Mains (=*U. puttemansii*)
Uromyces superfluus Syd. (VII)

Pappophorum (Festucae):
Puccinia gymnotrichis P. Henn. (Error, see *P. pappophori*)
Puccinia pappophori Cumm. (V)

Paspalidium (Paniceae):
Uromyces leptodermus Syd. (V)
Uromyces linearis Berk. et Br. (V)

Paspalum (Paniceae):
Angiopsora compressa Mains (II)
Puccinia araguata Kern (V)
Puccinia atra Diet. et Holw. (VII)
Puccinia chaetochloae Arth. (I)
Puccinia circumdata Mains (error for *P. dolosa*)
Puccinia compressa Arth. et Holw. (=*Angiopsora compressa*)
Puccinia coronata Cda. (Host?) (II, VI)
Puccinia dolosa Arth. et Fromme (I)
Puccinia dolosoides Cumm. (V)
Puccinia emaculata Schw. (Host?) (V)
Puccinia levis (Sacc. et Trott.) Magn. (V)
Puccinia macra Arth. et Holw. (VI)
Puccinia maublanchii Rangel (=*P. chaetochloae*)
Puccinia paspali Tracy et Earle (=*P. levis*)
Puccinia paspalicola Arth. (=*P. substriata*)
Puccinia paspalicola Kern, Thurston, et Whet. (=*P. araguata*)
Puccinia paspalina Cumm. (V)
Puccinia penniseti Zimm? (V)
Puccinia pilgeriana P. Henn. (=*P. substriata*)
Puccinia pseudoatra Cumm. (VIII)
Puccinia substriata Ell. et Barth. (V)
Puccinia tubulosa Arth. (=*P. substriata*)
Uredo cubangoensis Rangel (=*Puccinia substriata*)
Uredo paraphysata Karst. (II)
Uredo paspali-longiflori Petch (VI)
Uredo paspalina Syd. (=*Puccinia paspalina*)
Uredo paspali-perrottetti Petch (V)
Uredo paspali-scrobiculati Petch (I)
Uromyces aegopogonis Arth. et Holw. (Host?) (VI)
Uromyces paspalicola Arth. et Holw. (VI)

Penicillaria, see Pennisetum
Pennisetum (Paniceae):
    Phakopsora apoda (Hariot et Pat.) Mains. (II)
    Puccinia abnormis P. Henn. (=P. flaccida)
    Puccinia apoda Hariot et Pat. (=Phakopsora apoda)
    Puccinia atra Diet. et Holw. (VII)
    Puccinia arthurii Syd. (V)
    Puccinia burmeisterii Speg. (=P. gymnotrichis)
    Puccinia cenchri Diet. et Holw. (Host?) (V)
    Puccinia chaetochloae Arth. (I)
    Puccinia flaccida Berk. et Br. (Host?) (VI)
    Puccinia gymnotrichis P. Henn. (V)
    Puccinia levis (Sacc. et Bizz.) Magn. (V)
    Puccinia penicillaria Speg. (V)
    Puccinia penniseti Zimm. (V)
    Uromyces beckeropsidis Castellani (V)
Perieilema (Agrostideae):
    Puccinia dochmia Berk. et Curt. (VI)
Perotis (Zoysieae):
    Puccinia perotidis Cumm. (VI)
Phacelurus (Andropogoneae):
    Puccinia miscanthi Miura (I)
    Uromyces vossiae Barclay (VII)
Phalaris (Phalarideae):
    Puccinia addita Syd. (II)
    Puccinia angulosi-phalaridis Poeverl. (=P. sessilis)
    Puccinia brevicornis Ito (=P. coronata)
    Puccinia coronata Cda. (II, VI)
    Puccinia digraphidis Soppit (=P. sessilis)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
    Puccinia graminis Pers. (V)
    Puccinia orchidearum-phalaridis Kleb. (=P. sessilis)
    Puccinia phalaridis Plowr. (=P. sessilis)
    Puccinia schmidtiana Diet. (=P. sessilis)
    Puccinia sessilis Schneid. (VI)
    Puccinia striatula Peck (=P. sessilis)
    Puccinia striiformis West. (VI)
    Puccinia winteriana Magn. (=P. sessilis)
    Rostrupia addita (Syd.) Viennot-Bourgin (=P. addita)
    Uromyces phalaridicola Katajev (VI?)
Phleum (Agrostideae):
    Puccinia coronata Cda. (II, VI)
    Puccinia graminis Pers. (V)
    Puccinia phlei-pratensis Eriks. et E. Henn. (=P. graminis)
    Puccinia poae-nemoralis Otth (II)
    Puccinia poarum Niels. (VI)
    Puccinia taminensis (=P. poarum)
    Uromyces dactylidis Otth (VI)
    Uromyces phlei-michelii Cruch. (=U. dactylidis)
Phragmites (Festuceae):
    Puccinia arundinacea Hedw. f. (=P. phragmitis)
    Puccinia abei Hirat. (IX)
    Puccinia alnetorum Gaeum. (=P. magnusiana)
    Puccinia cagayanensis Syd. (VII)

Puccinia inulae-phragmiticola Tranz. (V)
Puccinia invenusta Syd. (I)
Puccinia isiacae Wint. (V)
Puccinia longinqua Cumm. (V)
Puccinia magnusiana Koern. (II)
Puccinia moriokaensis Ito (I)
Puccinia obtusata (Otth) E. Fisch. (=<u>P</u>. <u>isiacae</u>)
Puccinia okatamaensis Ito (IX)
Puccinia phragmitis Koern. (V)
Puccinia simillima Arth. (=<u>P</u>. <u>magnusiana</u>)
Puccinia tepperii F. Ludwig (II)
Puccinia trabutii Roum. et Sacc. (=<u>P</u>. <u>isiacae</u>)
Puccinia trailii Plowr. (=<u>P</u>. <u>phragmitis</u>)
Uredo phragmites-karkae Saw. (VII)
Uromyces blandus Syd. (V)

<u>Phyllostachys</u> (Bambuseae):
Puccinia longicornis Pat. et Hariot (I)
Puccinia melanocephala Syd. (I) (Amer. coll. = <u>P</u>. <u>phyllostachydis</u>)
Puccinia phyllostachydis Kus. (I)
Stereostratum corticioides (Berk. et Br.) Magn. (V)

<u>Piptatherum</u>, see <u>Oryzopsis</u>

<u>Piptochaetium</u> (Agrostideae):
Puccinia graminella Diet. et Holw. (IX)
Puccinia piptochaetii Diet. et Neger (V)

<u>Pleioblastus</u> (Bambuseae):
Puccinia kusanoii Diet. (V)
Puccinia melanocephala Syd. (I)
Stereostratum corticioides (Berk. et Br.) Magn. (V)

<u>Poa</u> (Festuceae):
Puccinia agropyri-ciliaris Tai et Wei (VI)
Puccinia baldensis Gaeum. (=<u>P</u>. <u>poarum</u>)
Puccinia cognatella Bub. (=<u>P</u>. <u>poae-nemoralis</u>)
Puccinia coronata Cda. (II, VI)
Puccinia crandallii Pamm. et Hume (VI)
Puccinia epiphylla Wettst. (=<u>P</u>. <u>poarum</u>)
Puccinia exigua Syd. (II)
Puccinia graminis Pers. (V)
Puccinia persistens Plowr. (=<u>P</u>. <u>recondita</u>)
Puccinia petasiti-poarum Gaeum. et Eichh. (=<u>P</u>. <u>poarum</u>)
Puccinia petasiti-pulchellae Ludi (=<u>P</u>. <u>poarum</u>)
Puccinia poae-alpinae Eriks. (=<u>P</u>. <u>poarum</u>)
Puccinia poae-nemoralis Otth (II)
Puccinia poae-pratensis Miura (=<u>P</u>. <u>coronata</u>)
Puccinia poae-sudeticae Joerst. (=<u>P</u>. <u>poae-nemoralis</u>)
Puccinia poae-trivialis Bub. (=<u>P</u>. <u>poarum</u>)
Puccinia poarum Niels. (VI)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=<u>P</u>. <u>recondita</u>)
Puccinia subandina Speg. (=<u>P</u>. <u>graminis?</u>)
Puccinia thalictri-poarum E. Fisch. et Mayor (=<u>P</u>. <u>recondita</u>)
Uredo poiophila Speg. (IX)
Uromyces chubutensis Speg. (=<u>U</u>. <u>fuegianus</u>)
Uromyces dactylidis Otth (VI)
Uromyces fuegianus Speg. (VI)

Uromyces otakou Cunn. (VI)
Uromyces poae Rab. (=U. dactylidis)
Uromyces poae-alpinae Rytz (=U. dactylidis)
Pogonarthria (Festuceae):
Puccinia pogonarthriae J. Hopkins (VI)
Uredo pogonarthriae Syd. (VI)
Pogonatherum (Andropogoneae):
Puccinia pogonatheri Petch (I)
Pollinia, see Eulalia and Microstegium
Puccinia eulaliae Barclay (=P. erianthi on Erianthus)
Puccinia kimurai Hirat. et Yoshinaga (=P. levis on Digitaria)
Polypogon (Agrostideae):
Puccinia coronata Cda. (II, VI)
Puccinia graminis Pers. (V)
Puccinia mediterranea Trott. (=P. coronata)
Puccinia polypogonis Speg. (VI)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Uredo polypogonis Speg. (=P. polypogonis)
Polytrias, see Eulalia
Pseudanthistiria (Andropogoneae):
Uredo anthistiriae Petch (VI)
Pseudoraphis (Paniceae):
Puccinia brachycarpa Syd. (I)
Pseudosasa (Bambuseae):
Dasturella divina (Syd.) Mundk. et Kheswalla (I)
Puccinia kusanoii Diet. (V)
Puccinia longicornis Pat. et Hariot (I)
Puccinia mitriformis Ito (IX)
Psilurus (Hordeae):
Puccinia baudysii Picb. (=P. schismi?) (VI)
Puccinia graminis Pers. (V)
Puccinellia (Festuceae):
Puccinia cinerea Arth. (=P. recondita)
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia poae-nemoralis Otth (II)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Uredo atropidis-distantis Magn. (=Puccinia poae-nemoralis)
Uromyces atropidis Tranz. (=U. dactylidis)
Uromyces dactylidis Otth (VI)
Redfieldia (Festuceae):
Puccinia redfieldiae Tracy (VII)
Relchella, see Calalmagrostis
Reimarochloa (Paniceae):
Puccinia levis (Sacc. et Bizz.) Magn. (V)
Rhynchelytrum (Paniceae):
Diorchidium tricholaenae Syd. (=Puccinia levis)
Puccinia levis (Sacc. et Bizz.) Magn. (V)
Puccinia tricholaenae (Syd.) T.S. Ramak. et K. Ramak. (=P. levis)
Uromyces tricholaenae Gonz. Frag. et Cif. (=Puccinia levis)

Roegneria, see Agropyron
Rottboellia (Andropogoneae):
    Puccinia cacao McAlp. (Host?) (I)
    Puccinia microspora Diet. (Host?) (I)
    Puccinia purpurea Cke. (Host?) (II)
    Puccinia rottboelliae Syd. (V)
    Uredo rottboelliae Diet. (=P. cacao)
    Uredo tribulis Cumm. (V)
    Uromyces rottboelliae Arth. (=U. vossiae on Phacelurus)
Saccharum (Andropogoneae):
    Puccinia eulaliae Auth. no Barclay (=P. erianthi)
    Puccinia erianthi Padw. et Khan (I)
    Puccinia kuehnii Butl. (I)
    Puccinia miscanthi Miura (Host?) (I)
    Puccinia purpurea Cke. (Host?) (II)
    Puccinia sacchari Patel, Kamat et Padhye (=P. erianthi)
    Uromyces kuehnii Krueger (=Puccinia kuehnii)
Sacciolepis (Paniceae):
    Puccinia emaculata Schw.? (V)
Sasa (Bambuseae):
    Angiopsora divina Syd. (=Dasturella divina)
    Dasturella divina (Syd.) Mund. et Kheswalla (I)
    Puccinia kusanoii Diet. (V)
    Puccinia longicornis Pat. et Hariot (I)
    Puccinia mitriformis Ito (IX)
    Stereostratum corticioides (Berk. et Br.) Magn. (V)
    Uredo inflexa Ito (=Dasturella divina)
Sasaella (Bambuseae):
    Puccinia kusanoii Diet. (V)
Sasamorpha (Babmuseae):
    Puccinia longicornis Pat. et Hariot (I)
    Puccinia mitriformis Ito (IX)
    Puccinia sasae Kus. (I)
    Puccinia sasaecola Hara (I)
Schedonnardus (Chlorideae):
    Puccinia schedonnardi Kell. et Swing. (VI)
Schismus (Aveneae):
    Puccinia schismi Bub. (VI)
Schizachne (Festuceae):
    P. coronata Cda. (II, VI)
Schizachyrium, see Andropogon
Schizostachyum (Bambuseae):
    Puccinia ditissima Syd. (II) (see under Uredo)
Sclerochloa (Festuceae):
    Puccinia coronata Cda. (II, VI)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=P. recondita)
    Uredo sclerochloae Hariot (=Uromyces dactylidis)
    Uromyces dactylidis Otth (VI)
    Uromyces sclerochloae Tranz. (=U. dactylidis)
Scleropoa (Festuceae):
    Uromyces dactylidis Otth (VI)
    Uromyces scleropoae Baudys et Picb. (=U. dactylidis)

Scleropogon (Festuceae):
    Puccinia aristidae Tracy (VII, VIII)
Sclerostachya (Andropogoneae):
    Puccinia kuehnii Butl. (I)
Scolochloa (Festuceae):
    Puccinia coronata Cda. (II, VI)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=P. recondita)
Scribnera (Hordeae):
    Uromyces hordeinus Arth. (VI)
    Uromyces jacksonii Arth. et Fromme (=error for U. hordeinus)
Secale (Hordeae):
    Puccinia clematidis-secalis Dupais (=P. recondita)
    Puccinia coronata Cda. (II, VI)
    Puccinia dispersa Eriks. et E. Henn. (=P. recondita)
    Puccinia elymi West. (error for P. recondita)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
    Puccinia graminis Pers. (V)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=P. recondita)
    Puccinia striiformis West. (VI)
    Uromyces fragilipes Tranz. (VI)
Semiarundinaria (Bambuseae):
    Puccinia kusanoii Diet. (V)
    Stereostratum corticioides (Berk. et Br.) Magn. (V)
Sesleria (Festuceae):
    Puccinia pumilae-coronata H. Paul (=P. coronata)
    Puccinia sesleriae Reichardt (V)
    Puccinia sesleriae-coeruleae E. Fisch. (=P. sesleriae)
Setaria (Paniceae):
    Angiopsora cameliae (Mayor) Mains (II)
    Phakopsora setariae Cumm. (II)
    Puccinia atra Diet. et Holw. (VII)
    Puccinia cameliae Arth. (=Angiopsora cameliae)
    Puccinia catervaria Cumm. (I)
    Puccinia chaetochloae Arth. (I)
    Puccinia elgonensis Wakef. (V)
    Puccinia graminis Pers.? (V)
    Puccinia kigesiensis Wakef. et Hansf. (VII?)
    Puccinia levis (Sacc. et Bizz.) Magn. (V)
    Puccinia polysora Underw. (error)
    Puccinia pseudophakopsora Speg. (=no rust)
    Puccinia setariae Diet. et Holw. (VIII)
    Puccinia setariae-longiseta Wakef. et Hansf. (V)
    Puccinia setariae-viridis Diet. (=P. levis?) (V)
    Puccinia substriata Ell. et Barth. (V)
    Puccinia wiehei Cumm. (V)
    Uredo palmifoliae Cumm. (II)
    Uredo panici-plicati Saw. (V)
    Uredo setariae Speg. (V)
    Uredo setariae-onuri Diet. (IX)
    Uromyces leptodermus Syd. (V)
    Uromyces niteroyensis Rangel (=U. puttemansii)
    Uromyces puttemansii Rangel (I)

Uromyces sepultus Mains (=U. puttemansii)
Uromyces setariae-italicae Yoshino (=U. leptodermus)
Sieglingia, see Tridens
Sinoarundinaria (Bambuseae):
Puccinia phyllostachydis Kus. (I)
Stereostratum corticioides (Berk. et Br.) Magn. (V)
Sitanion (Hordeae):
Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=P. striiformis)
Puccinia graminis Pers. (V)
Puccinia montanensis Ellis (II)
Puccinia pattersoniana Arth. (VI)
Puccinia recondita Rob. ex Desm. (VI)
Puccinia rubigo-vera Wint. (=P. recondita)
Puccinia striiformis West. (VI)
Snowdenia (Arthropogoneae):
Uromyces snowdeniae Cumm. (VI)
Sorghastrum (Andropogoneae):
Puccinia virgata Ell. et Ev. (I)
Sorghum (Andropogoneae):
Puccinia eulaliae Auth. (Host?) (=P. miscanthi)
Puccinia jaagii Boed. (V)
Puccinia nakanishikii Diet. (Host?) (I)
Puccinia purpurea Cooke (II)
Puccinia sorghi-halepensis Pat. (=P. purpurea)
Uredo geniculata Cumm. (II)
Uromyces andropogonis Tracy (Host?) (VII)
Spartina (Chlorideae):
Puccinia distichlidis Ell. et Ev. (VI)
Puccinia fraxinata Arth. (=P. sparganioides)
Puccinia kelseyi Syd. (=P. distichlidis)
Puccinia peridermiospora Arth. (=P. sparganioides)
Puccinia seymouriana Arth. (V)
Puccinia sparganioides Ell. et Barth. (V)
Uredo spartinae-strictae Pat. et Hariot (=Uromyces argutus)
Uromyces acuminatus Arth. (VI)
Uromyces argutus Kern (V)
Uromyces spartinae Farl. (=U. acuminatus)
Sphenopholis (Aveneae):
Puccinia eatoniae Arth. (VI)
Puccinia graminis Pers. (V)
Spodiopogon (Andropogoneae):
Puccinia crassapicalis Bub. (VII)
Puccinia miyoshiana Diet. (VII)
Puccinia pachypes Syd. (II)
Puccinia rufipes Diet. (Host?) (I)
Sporobolus (Agrostideae):
Puccinia arundinellae-setosae Tai (I)
Puccinia cryptandri Ell. et Barth. (V)
Puccinia graminis Pers. (V)
Puccinia hibisciata Kell. (=P. schedonnardi)
Puccinia kakamariensis Wakef. et Hansf. (V)
Puccinia luxuriosa Syd. (VI)
Puccinia muhlenbergiae Arth. et Holw. (=P. schedonnardi)
Puccinia schedonnardi Kell. et Swing. (VI)

Puccinia simulans Pk. (=P. cryptandri)
Puccinia spegazziniella Sacc. et Trav. (=P. schedonnardi)
Puccinia sporoboli Arth. (V)
Puccinia subglobosa Speg. (=P. schedonnardi)
Puccinia sydowiana Diet. (=P. vilfae)
Puccinia tosta Arth. (=P. schedonnardi)
Puccinia vilfae Arth. et Holw. (V)
Puccinia verbeniicola Arth. (=P. vilfae)
Uredo egenula Arth. (V)
Uredo ignobilis Syd. (=Uromyces tenuicutis)
Uromyces ignobilis Arth. (=U. tenuicutis)
Uromyces sporoboli Ell. et Ev. (V)
Uromyces sporoboloides Cumm. (V)
Uromyces tenuicutis McAlp. (V)
Uromyces wellingtonica T.S. Ramak. et K. Ramak. (=U. tenuicutis)

Stapfiola (Festuceae):
Puccinia stapfiolae Mund. et Thirum. (=P. schismi?) (VI)

Stenotaphrum (Paniceae):
Puccinia stenotaphri Cumm. (I)
Uredo stenotaphri Syd. (=P. stenotaphri)
Uromyces ignobilis Arth. (doubtful, =U. leptodermus?)

Stereochlaena (Paniceae):
Puccinia penniseti Zimm.? (V)

Stipa (Agrostideae):
Puccinia avocensis Greene et Cumm. (IX)
Puccinia burnettii Griff. (V)
Puccinia coronata Cda. (II, VI)
Puccinia digna Arth. et Holw. (II)
Puccinia entrerriana Lindq. (V)
Puccinia flavescens McAlp. (VI)
Puccinia graminella Diet. et Holw. (IX)
Puccinia graminis Pers. (V)
Puccinia hierochloae Ito (=P. coronata)
Puccinia interveniens Bethel (IX)
Puccinia lasiagrostis Tranz. (VI)
Puccinia monoica Arth. (VI)
Puccinia nasellae Arth. et Holw. (II)
Puccinia oerteliana Tranz. (=P. stipina)
Puccinia oligocarpa Syd. et Butl. (II) (Host not Stipa; may be Calamagrosti
Puccinia saltensis Cumm. (II)
Puccinia scaber (Ell. et Ev.) Barth. (=P. substerilis)
Puccinia stipae Arth. (VI)
Puccinia stipae Hora (=P. stipina)
Puccinia stipae-sibiricae Ito (VI)
Puccinia stipicida Speg. (=P. interveniens)
Puccinia stipicola Speg. (=P. interveniens)
Puccinia stipina Tranz. (VI)
Puccinia substerilis Ell. et Ev. (VI)
Puccinia windsoriae Schw. (Host?) (VIII)
Puccinia wolgensis Nawashin (IX)
Uredo pencana Diet. et Neger (=Uromyces pencanus)
Uredo stipae Jacz. (IX)
Uromyces argentinus Speg. (=Puccinia cacao on Hemarthria)

Uromyces ferganensis Tranz. et Eremeeva (VI?)
Uromyces mussooriensis Syd. (VIII)
Uromyces pencanus Arth. et Holw. (VI)
Uromyces stipinus Tranz. et Eremeeva (IX)
Syntherisma, see Digitaria
Tetrarrhena (Phalarideae):
Uromyces ehrhartae McAlp. (VI)
Themeda (Andropogoneae):
Phakopsora incompleta (Syd.) Cumm. (II)
Puccinia burmanica Syd. et Butl. (=P. chrysopogi)
Puccinia chrysopogi Barclay (VI)
Puccinia themedae Hirat. (=P. versicolor)
Puccinia versicolor Diet. et Holw. (VI)
Uredo anthistiriae-tremulae Petch (IV)
Uredo themedae Diet. (=Puccinia versicolor)
Uredo themedicola Cumm. (=Uromyces clignyi)
Uromyces clignyi Pat. & Har. (VI)
Uromyces triandrae Ramak. T.S. et Sriniv. (=U. clignyi)
Thraysia (Paniceae):
Puccinia levis (Sacc. et Bizz.) Magn. (V)
Torresia, see Hierochloa
Trachynia, see Brachypodium
Trachypogon (Andropogoneae):
Puccinia eritraeensis Paz. (II) (P. erythraeensis)
Puccinia trachypogonis Speg. (=P. versicolor)
Puccinia versicolor Diet. et Holw. (VI)
Tragus (Zoysieae):
Uromyces tragi Wakef. et Hansf. (VI)
Trichachne (Paniceae):
Puccinia atra Diet. et Holw. (VII)
?Puccinia melanosora Speg. (=rust of Acicarpha)
Puccinia panicophila Speg. (=P. atra)
Puccinia substriata Ell. et Barth. (V)
Tricholaena, see Rhynchelytrum
Trichloris (Chlorideae):
Puccinia chloridis Speg. (VI)
Puccinia trichloridis Speg. (=P. chloridis)
Trichoneura (Chlorideae):
Uromyces trichoneurae Doidge (V)
Tricuspis, see Gouinia
Trichopteryx, see Loudetia
Tridens (Festuceae):
Puccinia cryptandri Ell. et Barth. (V)
Puccinia graminis Pers. (V)
Puccinia simulans (Pk.) Arth. (=P. cryptandri)
Puccinia triodiae Ell. et Barth. (=P. windsoriae)
Puccinia windsoriae Schw. (VIII)
Triniochloa:
Uredo triniochloae Arth. et Holw. (II)
Triodia, see Tridens
Triplacis (Festuceae):
Puccinia schedonnardi Kell. et Swing. (VI)

Tripogon (Chlorideae):
    Uromyces trichoneurae Doidge (V)
    Uromyces tripogonicola Payak et Thirum. (=_U. trichoneurae_)
Tripsacum (Tripsaceae):
    Angiopsora pallescens (Arth.) Mains (VI)
    Puccinia pallescens Arth. (=_Angiopsora pallescens_)
    Puccinia pattersoniae Syd. (=_P. tripsaci?_)
    Puccinia polysora Underw. (V)
    Puccinia tripsaci Diet. et Holw. (V)
    Puccinia tripsacicola Cumm. (IX)
    Uredo pallida Diet. et Holw. (=_Angiopsora pallescens_)
    Uromyces tripsaci Kern et Thurst. (=_Puccinia tripsacicola?_)
Trisetum (Aveneae):
    Puccinia austroussuriensis Tranz. (VI)
    Puccinia borealis Juel (error for _P. poae-nemoralis_)
    Puccinia coronata Cda. (II, VI)
    Puccinia distichophylli E. Fisch. (II)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=_P. striiformis_)
    Puccinia graminis Pers. (V)
    Puccinia leptospora Ricker (VI)
    Puccinia monoica Arth. (VI)
    Puccinia poae-nemoralis Otth (II)
    Puccinia poae-sudeticae Joerst. (=_P. poae-nemoralis_)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=_P. recondita_)
    Puccinia striiformis West. (VI)
    Puccinia thalyctri-distichophylli E. Fisch. et Mayor (=_P. recondita_)
    Puccinia triseti Eriks. (=_P. recondita_)
    Puccinia triseticola Tranz. (V)
    Uromyces dactylidis Otth (VI)
    Uromyces ranunculi-distichophylli Semadeni (=_U. dactylidis_)
    Uromyces triseti Katajev (=_U. dactylidis_)
    Uromyces volkartii Gaeum. et Terrier (=_U. dactylidis_)
Tristachya (Aveneae):
    Puccinia tristachyae Doidge (I)
Triticum (Hordeae): (some records refer to _Agropyron_)
    Puccinia actaeae-agropyri E. Fisch. (=_P. recondita_)
    Puccinia agropyri Ell. et Ev. (=_P. recondita_)
    Puccinia brachypus Speg. (=_P. recondita_)
    Puccinia elymi West. (error for _P. recondita_)
    Puccinia glumarum (Schmidt) Eriks. et E. Henn. (=_P. striiformis_)
    Puccinia graminis Pers. (V)
    Puccinia megalopotamica Speg. (=_P. graminis_)
    Puccinia persistens Plowr. (=_P. recondita_)
    Puccinia recondita Rob. ex Desm. (VI)
    Puccinia rubigo-vera Wint. (=_P. recondita_)
    Puccinia striiformis West. (VI)
    Puccinia tritici-duri Viennot-Bourgin (=_P. recondita_)
    Puccinia triticina Eriks. (=_P. recondita_)
    Puccinia triticorum Speg. (=_P. recondita_)
Urochloa (Paniceae):
    Uromyces leptodermus Syd. (V)

Valota, see Trichachne
Vossia, see Phacelurus
Vulpia, see Festuca
Weingaertneria, see Corynephorus
Zea (Tripsaceae):
    Angiopsora zeae Mains (VI)
    Puccinia maydis Bereng. (=P. sorghi)
    Puccinia pallescens Arth. (error for Angiopsora zeae)
    Puccinia polysora Underw. (V)
    Puccinia sorghi Schw. (V)
Zeugites (Festuceae):
    Uredo zeugitis Arth. et Holw. (V)
Zizania (Zizanieae):
    Puccinia zizaniae Schw. (=P. andropogonis on Andropogon)
    Uromyces coronatus Miyabe et Nish. (I)
    Uromyces zizaniae-lalifoliae Saw. (=U. coronatus)
Zoysia (Zoysieae):
    Puccinia ischaemi Diet. (=P. zoysiae)
    Puccinia zoysiae Diet. (VI)

GROUP I: UREDIA PARAPHYSATE; UREDIOSPORES ECHINULATE; PORES EQUATORIAL

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
ANGIOPSORA													
africana	h-y	1.5	4	16-20x26-33		*		g-ch	2	2-3	0	10-16x20-26	
DASTURELLA													
bambusina	y	?	2	17-21x22-29	*			ci-ch	1.5?	5-9	0	11-17x(14-18?)	
divina	y-g	1.5	3-4	16-23x22-33	*			ch	1-1.5	4-11	0	10-17x12-15	
PUCCINIA													
aestivalis	ci	1.5	3-4	18-21x20-25	*			g	2	4-8	25	11-16x29-40	III spores germinating, II par. capitate
andropogonicola	ci-ch	2	4-5	20-26x20-35	*			ch	2.5-3.5	9-12	70	22-27x40-56	II par. clavate-capitate
apludae	ci-ch	1.5	4	15-19x19-26	*			ch	2-2.5	3-5	80	20-26x36-43	II par. capitate
arthraxonis-ciliaris	y	1.5	4-5	18-23x23-30	*			ci-ch	1.5	3-5	20	20-25x38-48	II par. mostly clavate, incurved
arundinellae-setosae	ch	2-2.5	3-5	18-21x21-30	*			ch	1.5	2-4	20?	16-21x30-43	II par. clavate or capitate
benguetensis	ci	1.5	4-6	16-21x23-27	*			ch	1-1.5	2-3	25	16-19x29-34	II par. capitate
brachycarpa	g-ch	2.5-3.5	3-4	19-25x23-28	*			ch	1.5	1.5	30	17-24x24-33	III spores verruculose; lower pore depressed
cacao	ci-ch	2-2.5	3-4	23-29x32-40	*			ch	2-2.5	2-2.5	10	18-22x30-39	II par. very variable
catervaria	ci	1.5-2	4	19-24x24-29		*		ch	1-1.5	2-3.5	20	20-23x26-33	II par. cylindric-clavate; III spores mostly angular
chaetochloae	ci	2	3-4	22-27x30-38		*		ch	1.5	2-4	20	20-26x32-40	II par. cylindric, III spores mostly angular
chaseana	ci	1.5-2	4	20-25x25-30		*		ci-ch	1	3-6	15	16-21x33-43	II par. cylindric
circumdata	g-ci	1-1.5	3	19-24x23-32		*		ch	1-1.5	2-3	15	17-24x26-33	II par. cylindric-clavate, III spores angular, brittle
daisenensis	ci	1.5	4	19-23x26-33	*			ch	1.5-2	7-13	15	15-22x35-56	II par. capitate
dolosa	g-ci	1-1.5	3	16-20x19-25		*		ch	1-1.5	2-4	15	17-23x28-40	II par. cylindric, III spores angular, brittle
duthiae	ci-ch	1.5-2.5	5	18-23x26-32	*			ch	2.5-3	4-8	120	22-27x35-42	II par. capitate
ekmanii	y	1	4	18-23x23-27	*			ch	2-3	3-5	80	18-23x29-39	II par. cylindric or clavate
eragrostidis-superbae	ci-ch	1.5-2	4-6	17-25x27-32	*			ch	3-4	5-9	140	23-30x36-45	II spore apex 2-3, par. clavate-capitate
erianthi	ci	1.5	4-5	18-23x28-33	*			ch	1.5-2	3-4	12	17-21x30-43	II par. capitate
fragosoana	g-ch	2	4-5	20-27x30-43	*			ch	2	2-3	50	18-23x26-34	II spore apex 3-8
invenusta	y-ci	1.5	4	14-18x20-29	*			g-ch	2	3-5	105	15-20x30-42	II par. clavate or capitate
isachnes	ci	1.5	4	16-19x23-27	*			ch	1.5-2	4-7	70	20-24x35-45	II par. capitate
kuehnii	y-ci	1.5-2.5	4-5	17-26x30-43	*			y-g	1.5-2	1.5-2	15	10-18x25-40	II spore apex 3-5
longicornis	ci	3	3-4	24-33x28-36	*			g-ch	1.5-2	14-32	200	18-21x65-100	II par. clavate-capitate III spores verruculose
loudetiae	ci-ch	1.5-2	3	19-26x25-35	*			g-ch	1	1	30	13-18x28-42	II par. clavate or capitate
loudetiae-superbae	ch	1.5	3	17-21x21-28	*			ch	1.5-2.5	4-6	50	18-23x33-42	II par. capitate
melanocephala	ci	2-3	4	23-27x27-37	*			g-ch	1.5	2-3	65	18-24x41-58	II par. capitate
microspora	ci	1.5-2	4	16-21x23-27	*			ch	1.5	2-3	20	16-21x28-35	II par. capitate
miscanthi	ci	1.5-2	4-5	19-26x29-35	*			ch	1.5-2	4-6	12	16-23x40-60	II par. capitate
moriokiensis	y	1.5-2	5-6	14-19x26-30	*			ch	1.5-2.5	6-13	120	13-18x44-65	II par. cylindric-clavate

Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
moriokiensis	y	1.5-2											
nakanishikii	ci-ch	1.5-2.5	4-5	19-24x26-36	*			ch	2-3	4-8	65	20-25x33-44	II spore apex 2.5-3, par. clavate-capitate
oahuensis	ci	1.5	4-6	17-26x26-35		*	*	ch	1-2	3-6	15	17-23x28-40	II par. cylindric-clavate
operta	y-ci	1.5	4-6	18-28x22-36	*			ch	2.5-3.5	3-5	110	22-29x38-46	II spore apex 2-4.5, par. clavate or capitate
pappiana	ci	1.5-2	4	20-25x25-29	*			ch	2.5-3.5	5-10	85	17-24x40-55	II par. capitate
phyllostachydis	ci	2.5-3	4-5	21-25x24-33	*			ch	2-3	3-5	120	17-21x36-55	III spores verruculose II par. capitate, septate
pogonatheri	ci-ch	2	5	19-23x25-30	*			ch	2-2.5	7-10	85	20-24x40-48	II par. capitate
polliniae	y-ci	1-1.5	3-4	18-22x23-27	*			g-ch	1.5-2	4-7	70	15-23x33-43	II par. capitate; III spores germinating p.p.
polliniae-imberbis	ci	1.5-2	4-5	20-23x24-30	*			ch	1.5	2-4	40	18-21x24-33	II par. capitate
posadensis	ci-ch	1.5-2	4-5	19-25x28-33	*			ch	1.5-2	6-9	12	17-20x36-50	II par. capitate
pusilla	ci-ch	1.5-2	4	16-22x20-28	*			ch	1.5-2.5	2.5-5	65	20-25x29-36	II spore apex 2-2.5, par. capitate
rufipes	ci	2-2.5	4	18-25x27-33	*			ch	2.5-3	3-3.5	90	18-23x30-36	II spore apex 2.5-3, par. capitate
sasae	ci	3-3.5	5	32-35 diam.	*			ch?	2-3	2.5-3.5	?	14-20x37-80	III spores verruculose, II par. clavate-capitate
sasaecola	?	?	?	?	*			g	1.5-2.5	35-70	200	16-22x80-125	probably this group
stenotaphri	ci	1.5	4-5	25-28x30-40		*		ch	1.5	2.5-4	15	19-26x44-60	II par. cylindric
sublesta	ci	1.5-2	3-4	15-19x19-25	*			ch	2	3-3.5	20	18-20x24-28	II par. capitate
tristachyae	ci	2	5-7	21-30x28-34	*	?		g	1.5-2	2-3	45	15-30x28-60	II par. mostly capitate
unica	ci	1.5-2	4-5	18-23x23-28	*			ch	3-3.5	3-5	100	18-25x29-42	II par. mostly capitate
virgata	ch	2-3	3-6	20-27x31-40	*			ch	1.5-2	5-10	20	18-26x45-60	II par. clavate or capitate
<u>UREDO</u>													
arundinellae-nepalensis	y-g	1-1.5	4-5	17-23x25-33									phakopsoroid
arundinis-donacis	y-ci	2	4	14-21x26-34									II spore apex 3-4, par. capitate
cymbopogonis-polyneuri	ch	1.5-2	4	19-24x25-35									II par. capitate
cynodontis-dactylidis	ch	1.5-2	2	14-20x17-22									II par. cylindric-clavate
eulaliae-fulvae	y-g	1.5	5?	19-26x29-38									II spore apex 2-4, par. short, capitate
ignava	h-g	1-2	4?	14-19x23-27									phakopsoroid
ophiuri	ci-ch	1.5-2	2	23-28x28-40									II par. cylindric or clavate
paspali-scrobiculati	ch?	1.5-2	2	22-28x27-40									II spore apex 2-3
schizachyrii	ch	1.5-2	3	23-30x30-42									II spore apex 4-8
<u>UROMYCES</u>													
coronatus	g-ci	1.5-2	4-5	16-21x21-33	*			ch	1-1.5	4-13	50	12-20x25-40	coronate; II spore apex 3-4
halstedii	y-ci	1-1.5	3-4	16-21x22-28	*			g-ch	1-1.5	3-5	50	15-21x22-30	coronate
puttemansii	ci	1.5-2	3	20-27x29-38		*		ch	1	1.5-2.5	25	14-20x22-27	III spores often angular

GROUP II: UREDIA PARAPHYSATE; UREDIOSPORES ECHINULATE; PORES SCATTERED

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
ANGIOPSORA													
cameliae	h-y	1-1.5	7-9	15-21x19-28		*		ch	1.5	4-8	0	10-15x16-28	
clemensiae	y	1-1.5	?	16-19x21-26		*		ci	1.5	2-3	0	10-15x16-29	pores may be equatorial
compressa	h-y	1-1.5	?	15-18x20-26		*		ch	1.5	3-4	0	12-14x20-32	
digitariae	h-y	1-1.5	?	15-20x21-26		*		g	1-2	1-2	0	9-11x20-25	telia 1 spore deep
hansfordii	h-y	1.5-2	7-9	14-19x20-27		*		g-ch	1.5	2-5	0	9-17x18-30	
hiratsukae	h-ci	1-1.5	?	15-22x18-28		*		h-g?	1	1	0	13-16x15-20	
phakopsoroides	h-y	1-1.5	7-10	21-26x28-35		*		g	1	1-1.5	0	8-14x12-21	
PHAKOPSORA													
apoda	y	1-1.5	6-8	18-23x24-30		*		g-ch	1.5-2	2.5-5	0	14-20x16-32	
incompleta	h-y	1-1.5	6-8	15-21x21-29		*		g-ci	1-1.5	1.5	0	8-15x18-26	
loudetiae	y-ci	1-1.5	7-9	18-21x26-32		*		g	2	2-3	0	14-18x16-28	
oplismeni	y	1.5	6-8	17-21x22-26	*			h-y	0.5-1	1	0	10-15x15-23	III spores germinating
setariae	h-y	1-1.5	7-8	14-19x21-28		*		g	1-1.5	1.5-2.5	0	10-16x20-26	
PUCCINIA													
addita	h-y	1-1.5	6-8	15-21x16-25		*	*?	ch	1.5	3-4.5	10	15-20x25-54	rostrupioid, coronate; may = P. coronata
ammophilinae	h-y	1.5-2.5	6-8	21-26x23-36		*	*?	ch	1	4-5	15	16-20x38-60	II par. capitate; may = P. pygmaea
andropogonis-hirti	ci	1.5-2	8	19-26x25-33	*			ch	2-3	3-4	70	19-25x30-37	II par. clavate-capitate, usually curved
bottomleyae	ci	1.5-2.5	8	20-25x22-28	*			ch	2-3	4-6	150	21-26x31-40	II par. capitate
brachypodii	y	1.5-2	8	18-22x23-26		*		ch	1	2-4	10	15-21x28-35	II par. clavate-capitate, curved
coronata	h-y	1-1.5	6-8	13-26x14-36	*	*	*	ch	1-1.5	3-5	20	10-22x30-95	coronate; see Appendix I
decolorata	y	1	6	21-23x21-26	*			ch	2-3.5	6-9	65	18-23x29-36	II par. capitate
digitariae-velutinae	g-ci	1-1.5	6-8	18-26x25-33	*			g-ch	1-1.5	3-5	15	18-23x36-52	II par. mostly clavate
deschampsiae	h-y	1.5-2	8-11	18-23x25-30		*	?	ch	1.5-2	3-5	15	14-20x40-35	II par. mostly clavate
digna	y-g	1.5	6-8	20-27x23-30	*			ch	1.5-2.5	6-10	130	18-24x35-50	II par. capitate
distichophylli	y-g	1.5-2	8-10	21-25x25-30		*	*	ch	1.5	2-5	15	14-21x35-49	may = P. poae-nemoralis
enteropogonis	ci	1.5	6-8	18-20x19-25	*			ch	1.5-2.5	2.5-5	130	18-24x24-32	II paraphyses 1-septate
eragrostidicola	h-y	1.5-2	?	13-18x19-25	*			ch	2.5-3	4-6	70	23-27x29-35	II par. cylindric
eritraeensis	ci	1.5-2	5-8	20-23x24-30	*			ch	2.5-3	4-5	90	20-27x33-40	II par. clavate-capitate, usually curved.
exigua	y-g	?	?	17-24 diam.		*	*	ch	?	?	15?	15-22x30-40	II par. capitate; prob. = P. poae-nemoralis
eylesii	ci-ch	1.5-2	8	16-20x20-24	*			g-ch	5-8	8-12	150	27-38x35-45	II par. capitate
hyparrheniicola	ch	2-3	6-8	24-27x28-31	*			g	1-1.5	3-3.5	15	16-19x33-40	II par. clavate-capitate, curved
kenmorensis	ci-ch	1.5-2.5	6-8	19-23x23-29	*			ch	2-2.5	2-2.5	20	18-22x23-30	II par. mostly clavate-capitate
koeleriae	ci	1-1.5	8-10	19-25x23-30		*	*	ch	1	3-6	10	13-21x40-60	II par. clavate-capitate; may = P. pygmaea
kwanhsienensis	y-ci	2.5-3	4?	18-20 diam.	*			ch	1.5-2.5	3-11	60	15-23x37-57	II par. clavate or capitate
magnusiana	y	1.5-2	6-8	18-19x26-42	*			ch	1-1.5	4-16	50	15-20x32-55	II par. mostly clavate
montanensis	y-ci	1.5-2	8-10	19-26x21-32		*	*	ch	1.5-2.5	3-7	10	18-34x35-64	II par. clavate
nasellae	y-g	2	8	20-26x23-30	*			ch	2-3	5-12	60	16-22x30-40	II par. mostly clavate, curved
oligocarpa	ci	1.5	10	16-22x22-28		*	*	ch	1.5?	2-5	10	16-23x33-46	II par. clavate

Species	Urediospores				Telia			Teliospores					Special
	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	
pachypes	y	1.5	8	18-21x23-26	*			ch	2-2.5	3-5	80	23-26x31-37	II par. capitate
paradoxica	y	2-3	6-8	18-22x20-28	*			ch	2-2.5	2-2.5	35	20-26x32-40	III spores verrucose; lower pore depressed
poae-nemoralis	h-y	1.5-2	8	17-24x22-29		*	*	ch	1.5	3-6	10	14-20x36-50	II par. clavate-capitate, curved, neck constricted; amphispores occasional
purpurea	ci	2	5-8	23-29x30-40	*			ch	3-3.5	4-5	95	24-30x40-50	II par. clavate-capitate, usually curved
pygmaea	ci	1.5	8	19-29x21-33		*	*	ch	1	3-5	10	12-20x30-50	II par. capitate, III spores often angular
saltensis	ci	1.5-2	5-6	16-20x18-25	*			ch	1.5-2.5	7-9	55	16-19x33-46	II par. capitate
stichosora	ci	2-3	4-6	17-25x23-33	*			ch	1.5?	2.5-5?	40	20-25x28-38	II par. capitate
tepperii	y	?	9	18-23x26-30	*			g-ch	3-3.5	4-7	250	20-23x45-70	II par. capitate
<u>UREDO</u>													
agrostidis	y-g	2-3	6-8	21-24x24-27									II par. capitate
bromi-pauciflorae	y	1-1.5?	6-8	20-28x20-32									II par. clavate
crinitae	h-g	2-2.5	10-14	22-28x27-33									II par. capitate
dendrocalami	h-y	1.5	?	19-22x26-35									phakopsoroid
ditissima	y-ci	1.5	15-20	22-28x26-36									phakopsoroid; publ. as <u>Puccinia dit.</u>
geniculata	ci-ch	1.5-2	6-8	18-24x23-29									II par. clavate-capitate, curved
ischaemi-ciliaris	g-ci	2	8-10	24-28x28-37									II par. mostly clavate
ochlandiae	y	1	?	17-20x21-25									II par. mostly clavate phakopsoroid?
palmifoliae	y	1-1.5	?	17-20x21-27									phakopsoroid
paraphysata	h-y	1-1.5	8-10	17-20x19-26									phakopsoroid
triniochloae	y-ci	1	4-6	16-19x19-26									II par. cylindric to capitate
<u>UROMYCES</u>													
aristidae	g-ci	3-3.5	7-10	19-26x26-33	*			ch	2-3	4-7	100	18-26x23-30	teliospores smooth becoming tesselately cracked.

GROUP III: UREDIA PARAPHYSATE; UREDIOSPORES VERRUCOSE; PORES EQUATORIAL: NO SPECIES KNOWN

GROUP IV: UREDIA PARAPHYSATE; UREDIOSPORES VERRUCOSE; PORES SCATTERED

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
UREDO													
anthistiriae-tremulae	h-y	1-1.5	6-10	17-21x20-26									phakopsoroid?
karetu	h-y	2-2.5	6-10	20-25x24-35									II par. capitate
kerguelensis	h-y	1.5	?	16-20x18-26									II par. clavate or capitate
miscanthi-sinensis	y-ci	1.5	6-7	15-19x18-25									II par. clavate-cylindric, curved

GROUP V: UREDIA WITHOUT PARAPHYSES; UREDIOSPORES ECHINULATE; PORES EQUATORIAL

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
PUCCINIA													
advena	y-ci	1-1.5	2	17-21x35-44	*			g-ch	2	2	100	22-26x35-40	II spore apex 1.5-7, pores basal
andropogonis	ci	1.5-2	3-4	20-23x21-25	*			ch	1.5-2.5	5-8	70	16-21x30-44	II pores also basal and scattered
araguata	y-g	1-1.5	4	19-23x27-35	*			g-ch	1.5-2.5	4-9	40	24-30x44-53	
arthurii	g-ci	1.5	5	21-26x27-33	*			ch	2-3	4-7	90	18-24x30-43	
arundinariae	ci	2-3	3-4	22-26x27-34	*			g-ch	2-3	4-7	130	17-23x43-70	III spores minutely verruculose
bambusarum	g-ci	1.5-2	3	19-25x26-33	*			y-g	1-1.5	3-6	25	12-16x23-33	III spores germinating
belizensis	ci-ch	2-3	3-5	25-33x32-56	*			y-ci	2-3	3-4	100	20-27x30-45	II spore apex 4-6
brachiariae	y-ci	1.5-2	2-3	25-30x28-33	*			ch	2.5-4	4-8	60	25-35x34-48	diorchidioid
burnettii	y-g	3	4	21-25x26-30	*			ch	2.5-3.5	4-7	120	25-28x35-43	
cacabata	ci	1.5-2	3-4	19-23x26-29	*			ch	3-4	4-7	115	19-25x29-36	
cenchri	ci	2-3	2-3	23-32x30-44		*		ch	1.5	6-9	15	19-26x40-54	var. <u>africana</u> has 4-5 pores
chaetii	y-ci	1-1.5	3	17-23x23-29		*		ci-ch	1-1.5	1.5-2.5	15	18-26x39-44	
cryptandri	ci	2-2.5	4-5	18-26x26-40	*			ch	1.5-3	4-9	100	24-32x40-54	
deformata	h-y	1-1.5	2?	18-24x26-32	*			ch	3-4	5-7	200	21-27x32-39	
dolosoides	g-ci	1.5	3	21-27x27-33		*		ch	1-1.5	2-4	12	18-23x34-45	
elgonensis	ci	1.5-2.5	4	24-30x35-40	*			ch	1-1.5	3-6	10	16-20x30-43	
emaculata	ci	1.5-2	3-4	18-23x21-26	*			ch	1.5-2	4-8	60	16-23x30-44	
entrerriana	ci	1.5-2	3	14-20x16-22	*			ci	1.5-2	-7	90?	14-20x36-58	
erianthicola	ci	2-3.5	2	20-24x23-28	*			ch	2-2.5	5-8	40	16-20x32-42	
erythropus	ci-ch	2-3	3-4	18-25x25-33	*			ch	1.5-2.5	3-5	130	16-20x33-45	II spore apex 3-8
eucomi	h-y	2-2.5	3	18-22x26-32	*			ch	2.5-4	5-9	100	24-30x35-44	II spore apex 3-8
faceta	ci	1.5-2	4	16-20x23-27	*			ch	2-2.5	2.5-4.5	100	16-20x28-34	
graminicola	y	1-1.5	?	16-18x23-26	*			ch	1-2	3-5	90	20-24x25-30	diorchidioid
graminis	g-ci	1.5-2	4	13-23x23-40	*			ch	1.5	5-10	50	16-23x35-55	
gymnotrichis	ci	1.5	4	20-25x26-33	*			g-ch	1.5-2	5-9	60	16-20x34-45	
huberii	y-ci	1.5	3-4	18-23x20-27	*			ch	2	2.5-5	25	18-26x24-39	
hyparrheniae	h	1-1.5	3-4	24-27x27-33	*			g-ch	3-4	4-5.5	90	25-28x38-44	II spore apex 10-19
ichnanthi	ch	1.5-2	2-3	22-30x30-44	*			h-g	1	1	30	12-14x28-34	III spores germinating, collapsing
imperatae	h	1-2	4	18-22x23-30	*			ch	3-3.5	5-8	160	19-26x34-50	II spore apex 3-8
imposita	ci	1.5-2.5	3-4	23-30x27-35	*			ch	1.5-2.5	5-8	15	19-25x38-52	
inclita	y-ci	1-2	3	22-26x24-32	*			ch	2.5-3.5	3-6	90	23-29x35-43	
insolita	ci?	1.5-2	?	18-26x25-35	*			ch	?	-5	25?	18-24x25-35	
inulae-phragmiticola	g?	3	4	18-22x22-25	*			g-ch?	3-4?	-10	150?	22-27x38-49	sori large

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
isiacae	g	3	4-6	16-22x18-29	*			g	4-5	6-9	160	24-28x40-55	sori very large
jaagii	y-ci	1.5-2	4	17-22x22-27	*			ch	2.5-3.5	5-7	135	20-26x31-40	diorchidioid
kakamariensis	h	1-1.5	2-3	15-20x20-26	*			ch	2.5-3	4-8	150	20-27x30-44	
kawandensis	ci-ch	2.5-3	4-5	20-26x28-33	*			ch	2-3	4-7	90	25-29x33-43	
kiusiana	ci	1.5	2	17-20x22-30	*			ch	1	7-18	40	12-18x38-50	
kusanoii	y	2-3	3-4	20-29x28-40	*			g-ch	2-3	8-12	200	12-23x46-80	III spores minutely verruculose
lasiacidis	g	1	3-4	18-21x23-27	*			g	1-2	2-3.5	95	18-21x23-30	
levigata	ci	1-2	3	18-25x24-29	*			g-ci	1-1.5	3-5	90	18-26x25-38	diorchidioid
levis	ci-ch	1.5-2.5	2-3	19-26x23-30	*			ch	2.5-3.5	7-10	200	23-33x25-46	diorchidioid
longinqua	ci	2-2.5	3-4	13-17x21-26	*			ch	2.5-3	4-6	150	16-19x40-54	
lophatheri	y-ci	1.5	3	16-21x20-27	*			ch	2-2.5	4-8	70	20-29x23-30	diorchidioid
millegranae	h-y	1	3	20-24x26-30	*			y-g	1	4-7	45	15-19x35-43	
miscanthidii	h-y	1.5-2.5	3	19-23x24-30	*			ch	2-3	5-9	90	20-27x33-46	
moliniae	g-ci	3.5-5	3(-5)	20-24x22-29	*			g-ch	2.5-3.5	4-7	150	22-26x32-45	II spore apex sometimes thicker
negrensis	g-ci	1-1.5	3	18-21x21-27	*			ch	1.5	2-4	60	16-20x22-26	diorchidioid
nyasaensis	ch	2.5-3	3	23-26x28-32	*			ch	1.5-2	5-7	45	24-33x24-28	diorchidioid
olyrae-latifoliae	y	1.5	2-3	17-26x23-33	*			ch	3-3.5	3-3.5	60	15-26x23-39	III spores rugose7
opipara	h-y	1-1.5	3-4	25-31x31-40	*			ch	2-3	4-7	70	23-28x33-44	
orientalis	y-ci	1-1.5	2	18-21x26-38	*			ch	2-3	3-6	70	16-20x20-28	diorchidioid, II pores basal
panici	ci	1.5-2	3-4	18-25x22-28	*			ch	1.5-2	3-7	75	16-23x30-45	
pappophori	ci	1.5	4	24-29x31-38	*			ch	2-3	3-6	85	18-23x29-36	
paspalina	y-ci	1.5	3	19-26x25-35	*	?		y-g	1.5-3	3-3.5	15	23-30x38-46	
pennicillariae	?	?	?	?	?			ch?	?	?	15?	25x40-50	
penniseti	ci	1.5	4	21-26x28-40	*	?		ch	1.5	3-8	20	18-25x40-65	
phragmitis	ci	3-4	4	18-21x29-34	*			g-ch	2-3.5	4-7	200	16-21x45-64	
piptochaetii	ci	2-2.5	3-4	16-20x18-24	*			g-ch	2-2.5	3-7	50	15-19x30-42	
poliniicola	y	1.5-2.5	3	14-18x19-25	*			g-ch	3-3.5	4.5-6	90	17-22x27-36	II spore apex 2-5
polysora	y-g	1-2	4-5	23-29x29-36		*		ch	1.5	1.5-2.5	30	20-27x29-31	III spores angular, brittle
puttemansii	y-g	1.5	4	19-24x25-31	*			g-ch	1.5	4-7	40	16-20x30-37	
rottboelliae	ci	1.5	3	19-24x25-30	*			ch	2.5-3.5	5-8	170	20-27x34-50	
sesleriae	y-ci	2.5	4	17-18x26-28	*			ch	2-2.5	5-10	70	16-23x30-53	II spore apex 2.5-3.5
setariae-longisetae	ci	2-3	3-5	20-29x26-33	*			g-ch	2.5-3	5-10	110	23-27x38-54	
setariae-viridis	ci	1.5-2	3	17-25x25-31	*			ch	3?	4-6	90	22-32x35-54	diorchidioid7
seymouriana	h	2-3	?	16-27x29-44	*			ch	1.5-2	5-8	150	15-33x38-60	II spore apex 9-26
sorghi	ci	1.5-2	3-4	23-28x26-30	*			ch	1-2	5-7	80	16-22x30-45	
sparganioides	h	1.5-3	4	18-30x29-45	*			ch	1.5-2	5-7	100	14-23x38-62	II spore apex 7-10
sporoboli	ci	1-2	4-6	25-31x23-30	*			ch	1.5	5-10	50	16-26x28-50	II pores basal
subcentripora	y-g	3-4	4	24-30x29-36	*			ch	1.5-2	2	20	19-26x26-37	lower pore depressed
substriata	ci	1.5-2	4	23-30x28-36	*			ch	1.5-2	3-7	30	19-26x33-50	
taiwaniana	y-ci	1-1.5	3	15-18x18-25	*			ch	1.5-2.5	3-5	70	18-24x25-30	diorchidioid
torosa	y-g	3.5-5	4	17-23x27-37	*			g-ch	3	4-6	250	19-23x40-65	
tripsaci	g-ci	1.5-2	3	26-31x26-33	*			ch	2-3	5-8	90	19-27x30-40	
triseticola	y	1.5?	3-4	16-18x19-22		*	*	ci-ch	7	3-6	15	13-18x35-48	II pores subequatorial
vilfae	h	1.5-2	6-8	20-26x26-33	*			ch	1.5-2.5	5-9	115	18-26x38-55	II spore apex 5-10
wiehei	h-y	1.5-2	3-4	19-23x22-32	*			ch	2-3.5	8-12	120	20-26x34-50	II spore apex 5-10
STEREOSTRATUM													
corticioides	g-ci	1.5-2	2-3	14-20x16-27	*			y-g	2.5-3	2.5-3	350	19-25x24-32	

GROUP VI: UREDIA WITHOUT PARAPHYSES; UREDIOSPORES ECHINULATE; PORES SCATTERED

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
ANGIOPSORA													
aurea	h	1	?	16-19x22-26		*		h-y	1	1	0	8-13x14-20	
lenticularis	h-y	1-1.5	7-8	15-20x22-27		*		g	1-1.5	2-4	0	11-16x16-30	
pallescens	h-y	1-1.5	?	12-16x16-25		*		g	1-1.5	2-3.5	0	10-18x12-26	
zeae	h-y	1.5-2	?	15-20x22-30		*		g-ch	1.5-2	3-4	0	12-18x16-36	
PUCCINIA													
aegopogonis	g	1-1.5	6-8	20-25x23-28	*			ch	2	3-6	55	20-25x26-30	
agrophila	h	2-3	6-8	18-23x23-27	*			ch	3	4-6	135	21-26x33-40	
agropyri-ciliaris	y	1.5	6-8	15-20x19-26	*			y	1	3-5	15	6-14x40-70	III spores germinating
agropyricola	h-y	1-2	?	14-16x18-28		*		ch	1-1.5	3-5	15	15-24x32-52	rostrupioid
agrostidicola	y	1.5-2	8-10	23-30x24-33	*			ch	1.5-2	8-11	50	17-27x36-56	
amphigena	g-ci	1.5-2	8	18-23x21-27	*			ch	1.5-2.5	7-10	50	18-30x30-55	
andropogonis	ci	1.5-2	4-6	20-23x21-25	*			ch	1.5-2.5	5-8	70	16-21x30-44	also has equatorial pores
arthraxonis	h	3	7-9	18-25x23-30	*			ch	3-4	4-5	100	27-33x35-42	
arrundinellae	h-g	1.5-2	8	17-20x19-26	*			ch	2.5-3	5-9	130	20-27x33-46	
arundinellae-anomalae	h-y	2-3	8	18-25x26-35	*			ch	2-3	4-9	150	17-24x34-60	
australis	h-y	1.5-2	6-8	14-17x15-23	*			ch	2.5-4	7-12	100	19-25x30-40	
austroussuriensis	ci	?	5-6	20-33x30-34		*	*	ch	1.5?	2-4?	20?	17x36	
baudysii	?	1.5	?	19-23 diam.		*	*	ch	1-1.5	3-5	10	15-19x40-58	III spores often angular
boutelouae	h-g	1-3	8	18-25x21-29	*			ch	2.5-3	5-7	120	18-24x23-30	
bromoides	g-ci	1.5-2.5	4-7	23-26x25-30	*			g-ch	3.5-5.5	4-7	30	22-30x34-49	III spores verrucose
chloridis	h-g	1.5-2.5	4-8	18-22x18-23	*			ch	1.5-2.5	5-9	100	16-25x26-40	
chrysopogi	h-y	2-3	8?	20-23x24-30	*			ch	3-4	6-10	140	24-32x42-52	
conspicua	h-y	1.5-2.5	4-6	14-19x24-36		*		ch	1	3-5	10	18-26x28-45	III spores often angular
coronata	h-y	1-1.5	6-8	13-26x14-36	*	*	*	ch	1-1.5	3-5	20	10-22x30-95	coronate; see Appendix I
crandallii	y	2-2.5	8-10	23-27x29-35	*			ch	1.5-3.5	5-12	60	16-25x36-50	
cryptica	y-ci	1-1.5	6-8	19-26x21-29		*	?	ch	2-3	3-6	25	20-32x38-50	III spores angular, often ridged
diarrhenae	h-y	1-2	?	16-24x20-27	*			ch	1-1.5	5-10	50	12-20x40-52	coronate
dietelii	h-g	1.5-2	?	15-21x17-26	*			ch	2-3	5-7	75	17-24x24-35	II spore apex 3-10
diplachnicola	h	1.5	4-5	13-15x14-18	*			ch	2-2.5	3-5	100	13-19x27-37	
distichlidis	y	3-4	6-8	23-28x26-33	*			ch	1.5-2.5	7-13	115	19-27x42-64	
dochmia	y-g	1-1.5	6-8	18-23x20-27	*			ch	2-2.5	3-7	100	20-26x25-34	often diorchidioid
eatoniae	y-g	1-1.5	6-8	12-18x19-24		*	*	g-ci	1	3-6	12	11-19x30-50	III spores often angular
elymi	y-g	3.5	6-9	17-23x23-32		*	?	g-ch	1-1.5	-3	15	10-18x45-90	rostrupioid
epicampis	ci	2-3	6-8	21-25x23-29	*			ch	2.5-3.5	5-8	100	20-26x28-38	
eragrostidis	h	?	?	14-22 diam.	*			g-ch	?	?	50	15-17x20-32	
eragrostidis-ferrugineae	h	?	4-6	17-20x20-27	*			ch	1.5-2	3-6	115	14-21x26-41	
exasperans	ci	1.5-2	6-8	17-25x22-29	*			ch	1.5-3	4-10	125	17-26x24-31	often diorchidioid
festucae	y	1-1.5	5-7	18-23x22-26	*			g-ch	1-1.5	4-8	25	13-20x40-63	coronate
flaccida	ci-ch	1.5-2.5	4-6	18-25x23-29	*			g-ci	1-1.5	2-4	50	15-25x26-45	diorchidioid
flavescens	y-g	1.5-2	6-8	17-21x23-28	*			ch	2-3	5-8	65	19-23x38-50	
garnotiae	ci?	1.5-2?	4-6	19-28x25-46	*			ch?	1.5-2?	1.5-3?	?	16-22x40-80	II descr. as verrucose; probably echinulate
guaranitica	g-ci	2-4	4-6	17-23x20-28	*			ch	2-4	4-7	100	20-25x28-32	

Species	Urediospores				Telia			Teliospores					
	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
gymnopogonicola	h-y	1.5-2	?	13-16x16-22	*			g-ch	3-5	4-6	80	18-22x28-41	III wall bilamellate
heimerliana	y-ci	2	5	14-16x15-20	*			ch	1.5-2?	6-11	55	18-20x24-38	II spore apex 2-4
hordei	y	1.5-2	8-10	16-24x22-29		*	*	ch	1.5	3-6	15	18-25x39-58	III spores often angular, mesospores numerous
hordeina	?	?	3-4?	16-22x16-27		*	*	ch	?	5-8	15	11-27x37-89	
kansensis	h	1.5-2	6	15-18x17-22	*			ch	1.5-2.5	2-2.5	30	16-19x24-32	lower pore often depressed
koeleriicola	?	?	4-5	?		*	*	ch	1	2-4?	15?	12-15x52-75	
lasiagrostis	y	1.5?	8?	20-35 diam.	*			ch	1.5-2	7-14	175	16-26x40-75	
leptospora	h-y	1.5-2	?	17-20x24-29	*			ch	1.5	4-7	10	14-20x60-120	coronate
lepturi	y-ci	2-2.5	7	17-22x18-25	*			ch	3-4	4-5	50	21-27x25-32	
liatridis	h-y	1.5-2	6-8	18-23x23-30		*	*	ch	1-2	4-7	10	16-29x42-55	III spores often angular
longissima	g	1.5-2	10	18-28x27-35	*			g-ch	2-3	5-11	15	15-25x60-115	
luxuriosa	y-ci	2-2.5	6-8	20-25x26-32	*			ch	1.5-2.5	5-12	115	23-33x40-60	
macra	y	1-1.5	8	23-29x28-35	*			g-ch	2	5-8	65	20-28x39-50	
melicina	ci	1.5-2	6-8	19-25x22-27	*			ch	1.5-3	4-7	100	21-26x29-38	
micrantha	y-g	1.5	6-8	13-18x16-20	*			ch	1.5-2.5	6-13	70	18-26x30-50	
moliniicola	h-y	1.5	?	10-13x14-16	*			ch	1.5-2	3-5	90	12-17x26-38	
monoica	ci	2-3	6-8	19-27x24-31	*			g-ch	1.5-2	5-13	100	14-24x34-55	
moyanoi	y-g	1.5-2	8-10	18-25x23-29	*			g	1.5	4-6	65	21-24x36-46	
nyasalandica	h	1	?	14-18x19-21	*			g-ch	3-4	4-5	85	17-20x30-38	lower pore depressed
orzyopsidis	y	?	?	20-25 diam.	*			g?	4	7-9	100	20-25x34-46	
pattersoniana	g-ci	2-3	8-10	17-23x20-28	*			ci-ch	1-1.5	1-1.5	75	16-23x29-37	III spores striate
permixta	y-g	2-3	8	13-17x15-19	*			ch	2-3.5	4-10	90	20-29x28-45	
perotidis	ci	2-2.5	5-7	18-22x24-27	*			ch	2.5-3.5	4-6	65	19-25x30-36	
piperii	y	1.5-2	8-10	15-18x21-26		*	*	ch	1.5-2.5	3-5	30	19-26x42-62	III spores ridged, angular
piptatheri	ci	?	?	18-24x24-32		*	*	ch	?	?	10?	15-20x42-60	
poarum	h-y	1-1.5	6-8	16-24x19-29		*	*	ch	1-1.5	3-7	10	15-23x35-55	
pogonarthriae	ci	1.5-2.5	6	18-22x22-26	*			g	3-4	4-5	75	19-25x28-36	lower pore depressed
polypogonis	g-ci	2-3	5-6	19-24x23-28	*			g-ch	1.5-2.5	4-7	60	16-23x35-55	
praegracilis	y	1-1.5	6	16-19x16-21		*	*	ch	1	2-4	10	11-17x29-47	coronate
pratensis	y-ci	2-3	8	23-30x27-36	*			ch	5-6	?	30	27-32x35-50	III spores verrucose, lower pore depressed
recondita	y-ci	1-2	6-10	14-32x16-48		*	*	ch	1-1.5	3-7	10	10-25x32-85	See Appendix II
schedonnardi	y-ci	1.5-2	6-8	18-26x19-28	*			ch	1.5-2	3-7	130	16-25x27-42	
schismi	h-y	1.5-2.5	8-10	18-24x22-29		*	*	g-ch	1.5-2.5	3-8	20	18-25x40-62	III spores often angular
scillae-rubrae	h	1-1.5	5-7	24-32 diam.		*		g	1	1-3	30	17-23x45-60	III spores ridged, angular
sessilis	ci	1.5-2	8	18-24x23-30		*		ch	1.5	3-5	10	16-23x35-55	III spores often angular
sinica	h	1.5	?	12-13x14-19	*			ch	2?	3-5.5	70	12-17x26-38	
stapfiolae	y-ci	1.5-2	8	17-21x19-25		*	*	ch	1-1.5	3-6	10	17-20x37-55	III spores often angular
stipae	y-ci	1.5-2.5	6-8	18-23x21-26	*			ch	1.5-2	5-10	165	18-25x35-64	
stipae-sibiricae	y-ci	2	6	15-18x16-22	*			ch	1.5-2.5	5-12	100	16-23x34-52	
stipina	y	2	8-10	18-23x22-27	*			g-ch	2-2.5	6-10	140	16-23x40-60	
striiformis	h	1-2	10-15	19-26x19-30		*	*	ch	1	3-6	15	13-24x32-56	sori in lines
substerilis	ci	1.5-2	4-6	17-23x21-27	*			g-ch	1.5	3-7	80	16-22x36-46	amphispores formed
subtilipes	h-y	1-1.5	?	13-15x16-18	*			ch	2-3	2.5-3.5	130	18-22x23-31	
tomipara	y-g	1.5	6-8	17-21x18-25		*	*	g-ch	1-1.5	2-4	10	16-29x33-58	rostrupioid and muriform
tornata	h-y	1.5	8	20-24x22-27	*			ch	1-2	1-2	50	16-22x26-40	
versicolor	h	2-7	8-11	21-28x25-33	*			ch	3-4	4-8	130	25-32x35-46	II spore lumen stellate
versicoloris	y-g	2	12	23-26x28-35	*			g-ch	4-7	4-7	30	22-40x38-70	III spores verrucose, lower pore depressed
vexans	y-ci	2-3	8	24-29x26-32	*			ch	2.5-3	6-12	110	23-29x32-40	amphispores predominate
zoysiae	h-y	2-2.5	5-7	15-17x18-22	*			ch	2-3	4-6	100	16-21x28-42	II spore apex 2.5-4

Species	Urediospores Wall Color	Urediospores Side Wall	Urediospores Pores	Urediospores Spore Size	Telia Nak	Telia Cov	Telia Par	Teliospores Wall Color	Teliospores Side Wall	Teliospores Apical Wall	Teliospores Ped	Teliospores Spore Size	Special
<u>UREDO</u>													
arundinellae	g-ci	1-1.5	3-4	26-29x27-37									
detenta	ci-ch	2.5-4	3-4	20-28x28-36									
egenula	ci	1.5-2.5	2	21-25x26-34									
henningsii	ci	1.5-2	3-4	18-25x20-28									
morobeana	g-ci	1.5-2	3-4	20-35x25-31									
nakanishikii	y-g	2-2.5	4	18-21x20-24									
panici-montanae	y-ci	1	2?	16-20x19-25									
panici-plicati	ci	1.5	3	23-28x31-40									
panici-urvilleanae	g-ci	2-2.5	3-4	20-25x25-30									
paspali-perrottettii	ci?	1.5	4	17-19x19-26									
ravennae	y-g?	1.5-2	3-4	24-28x30-40									
setariae	ci	2	3	23-28x27-32									
tribulis	ch	2-3	3-4	15-22x25-30									apex 3-5
zeugites	ci	1.5-2.5	3-4	19-21x23-26									
<u>UROMYCES</u>													
apludae	y-ci	1.5-2	3	16-20x17-22	*			ch	1.5-2	2-4	40	15-23x22-27	III spores often angular
argutus	g-ci	2-3	2-3	19-23x25-32	*			g-ch	1.5-2	7-10	65	16-19x28-38	
beckeropsidis	y	2-3	?	16-20x20-22	*			ch	3	5-6	70	17-24x22-30	pores not described
blandus	g-ci	2.5-3	3-4	20-24x20-29	*			g-ch	2-3.5	3-7	80	19-24x24-30	
costaricensis	y-ci	1	2-4	16-21x20-28	*			g-ch	1	2-4	45	14-20x23-32	
dactyloctenii	g	1.5-2	3-4	18-23x23-27		*		ch	1.5-3	3-6	25	16-22x23-30	<u>U. dactylocteniicola</u> probably based on stray III spores
graminicola	g-ci	2-2.5	3-4	17-23x20-26	*			ch	1.5-2	3-9	80	13-19x21-32	III spores often angular
leptodermus	ci	1.5-2	3	23-27x27-33		*		g-ch	1-1.5	1-1.5	20	16-21x19-27	III spores mostly angular
linearis	ci	2.5-3	3-4	20-25x22-28	*			ch	2-3	5-8	90	18-23x23-30	
major	g-ci	2-2.5	4	19-23x21-26	*			ch	2-2.5	5-8	75	20-23x23-27	
microchloae	y-g	1.5	4	16-18x18-21	?	*		ch	1.5-3	2-3	25	18-23x23-29	III spores often angular
muhlenbergiae	g	2-3	3-4	15-20x17-24	*			ch	1.5-2	5-10	30	14-21x18-28	
schoenanthi	y-ci	1.5-2	3	16-20x18-25	*			ch	1.5-2	2-4	45	17-23x21-28	III spores often angular
sporoboli	g-ci	1.5-2	4-5	23-30x29-42	*			ch	1.5-2.5	5-8	110	19-28x29-40	
sporobolbides	g-ci	2	4	20-26x26-34		*	*	ch	1.5-2.5	3.5-5	30	20-26x29-33	III spores mostly angular
tenuicutis	y-ci	1.5	3-5	19-24x25-32		*	?	g-ch	1-1.5	2-4	45	16-23x21-30	III spores mostly angular
trichoneurae	ci	1.5	3	22-25x27-33	*			ch	1-2	3-5	45	16-20x23-32	III spores often angular; II pores rarely scattered

Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
UREDO													
andropogonis-lepidi	h-y	1.5-3	6-8	16-23x17-27									
andropogonis-zeylandicae	h-y	2	?	20-25x22-28									
anthistiriae	y-g	2	8-10	21-25x23-30									
ehrhartiae-calycinae	y-ci	3.5-4	4-6	18-20x20-29									
ischaemi	h	1.5	8-10	13-17x16-22									
kigesiensis	h-y	1.5	?	14-19x19-26									
martynii	y-g	1.5	?	18-24x23-33									
paspali-longiflorae	y	1.5	8-10	22-27 diam.									
pogonarthriae	y-ci	1.5-2.5	6	18-22x22-26									
tacita	y-g	2-2.5	5-8	19-23x23-27									
toetoe	ci-ch	2.5-3	7-12	22-29x27-34									
yoshinagai	h	2-3	4-13	18-26x21-35									
UROMYCES													
acuminatus	h-g	2-3.5	7-10	19-27x25-35	*			g-ch	1.5	5-12	70	15-20x25-38	III spore apex variable, commonly accuminate
aegopogonis	y-g	1.5-2	6-8	16-19x19-23	*			ch	2-2.5	5-8	60	19-24x22-26	
amphydimus	y-g	1.5-2	7-9	16-21x18-26	*			g	1-1.5	3-7	50	14-19x21-34	
beckmanniae	h-y	2-2.5	8-10	19-24x23-29		*	*	ch	1-2	3-6	40	20-26x29-40	III spores often ridged, angular
bromicola	y	1.5-2	9-11	20-26x23-29		*		ch	2-3	2.5-3.5	25	21-28x23-35	III spores mostly angular
brominus	g-ci	1.5-2	5?	21-28x23-30	*?	*?		ch	1.5	3	30	19-29x14-27	III spores ridged
clignyi	g-ci	1.5-2	7-10	20-24x26-30	*			ch	3-5	3-6	110	22-30x25-32	III spores opague, pedicels deciduous
dactylidis	y-ci	2	5-8	14-25x17-29		*	*	g-ch	1-2	2-4	25	13-23x20-38	See Appendix III
danthoniae	y-g	2-3.5	7-10	23-27x27-35	*			ch	1.5-3	6-10	100	18-24x28-37	autoecious
ehrhartae	y-ci	1-1.5	6-8	17-20x21-27	*			ch	2	8-12	50	12-18x20-32	III spores variable, apex often pointed
epicampis	ci	2-2.5	6-8	21-25x24-30	*			ch	1.5-2	4-7	100	16-24x24-31	
eragrostidis	g-ci	1-1.5	4-6	16-20x20-26	*			ch	1.5-2.5	5-7	75	16-23x23-31	
ferganensis	?	?	5-6	21-27x21-27	?			y?	?	-8	?	21-24x21-30	
fragilipes	?	?	?	?		*?	*?	ch	?	thin	30	16-20x20-27	undoubtedly this group; near U. mysticus
fuegianus	h	2.5-3.5	10-13	25-33x29-40	*			ch	1.5-2.5	4-8	80	23-28x28-40	
graminis	y-ci	2.5-3.5	5-8	22-25x24-28	*			ch	1.5-3	4-9	50	16-27x22-38	
hordeinus	y-g	1.5-2	8-10	16-24x22-27		*	*	ch	1.5-2.5	3-6	20	15-25x26-35	III par. especially on sheaths, spores angular
kenyensis	ci	1.5-2.5	6-8	15-20x17-24	*			ch	2-2.5	5-8	60	17-20x18-24	
leptochloae	g	2.5	7-8	20-24x23-27	*			ch	2-2.5	6-10	50	20-24x22-28	
minimus	y-ci	1.5-2	4-6	13-17x15-20	*			ch	1.5-2	5-9	30	12-17x14-23	
mysticus	y-g	2-2.5	8-12	20-25x25-30	?	*		ch	1.5-2.5	1.5-2.5	25	18-25x23-34	III covered but pulverulent, spores angular and ridged
nasellae	h	2.5	10-13	23-28x28-35	*			ch	2-3	5-8	70	21-24x30-36	
otakou	h-g	1.5-2	7-10	17-25x24-30	*			ch	2-2.5	6-11	60	18-23x25-31	
paspalicola	h-y	1	6-8	17-20x19-25	?	*		ch	2-2.5	2-3.5	30	20-24x23-30	III spores mostly angular
pegleriae	y-g	1.5-2	7-9	16-22x21-27		*		ch	1.5-2.5	3-5	25	15-20x24-30	III spores mostly angular
pencanus	g-ci	2-3	5-8	22-26x26-30	*			ch	2-3	5-11	70	18-24x26-32	autoecious
phalaridicola	y-(ci?)	1.5-2	3?	20-22x20-30		*	*	ch	2-2.5	3-5	25	15-22x21-27	

Species	Urediospores Wall Color	Side Wall	Pores	Spore Size	Telia Nak	Cov	Par	Teliospores Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
snowdeniae	h-y	1-1.5	5-7	15-18x17-20	*			ch	2-2.5	3.5-5.5	45	17-21x21-27	
tragi	g-ci	1-1.5	4-7	16-19x23-27	?	*		ch	1.5	2-4	25	17-22x24-30	III spores often angular, ridged
turcomanicum	h-y	1-1.5	6-8	18-20x20-25	?	*		ch	1	1	20	14-19x15-19	III covered but pulverulent

GROUP VII: UREDIA WITHOUT PARAPHYSES; UREDIOSPORES VERRUCOSE; PORES EQUATORIAL

Species	Urediospores Wall Color	Side Wall	Pores	Spore Size	Telia Nak	Cov	Par	Teliospores Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
PUCCINIA													
aeluropodis	y-ci	2-2.5	3-4	18-23x18-26	*			ch	2	5-9	90	18-24x35-50	
anthephorae	ci	2.5-3.5	3-4	19-26x24-30	*			ch	3-4	5-7	100	21-26x30-40	
aristidae	g	3-5	3-5	18-24x19-33	*			ch	2-4	6-10	130	18-29x30-50	pores also scattered
atra	g-ci	2.5-3.5	4-6	24-29x27-36	*			ch	2.5-3.5	4-8	120	22-29x30-41	
cagayanensis	y-g	1.5-2	3-4	15-18x19-24	*			ch?	1.5-2	2-2.5	35	14-18x28-38	
cesatii	g-ci	3-4	4-5	19-24x23-28	*			ch	1.5-3	4-7	80	24-27x32-38	amphispores in some specimens
crassapicalis	g-ci	3-3.5	2-3	19-25x23-30	*			ch	2-3	10-16	100	19-27x40-56	
cymbopogonis	g-ci	3-4	3-5	19-24x23-29	*			ch	2-3	7-9	80	24-30x35-42	
cynodontis	g-ci	2-3	2-3	19-23x20-26	*			ch	1.5-2.5	6-12	80	16-22x30-55	
daniloi	g-ci	3-3.5	2	19-25x25-30	*			ch	2-3	6-12	80	20-24x36-50	
ellisiana	g-ci	2.5-4	3-4	18-20x19-22	*			ch	2-3	7-9	85	18-23x31-45	
eragrostidis-arundinaceae	ci?	3.5	2-3	24-35x24-35	*			ch	1.5-2?	-6	50?	21-32x35-48	
infuscans	g-ci	2.5-3	3-5	21-24x25-29	*			g-ci	1.5-2	5-7	60	18-21x30-40	
kigesiensis	y-ci	2	4-5	25-28x29-35	*			ch	1-1.5	2-5	20?	17-25x28-39	
meridensis	g	2-3	4	21-25x23-29	*			g-ci	1.5-2	4-7	60	16-19x33-47	
miyoshiana	g	2.5-3	3-4	19-23x22-26	*			ch	2-3	6-10	100	19-26x30-43	
pseudocesatii	g-ci	2.5-3.5	2-3	19-24x23-28	*			ch	2-3	8-12	90	18-23x40-48	
redfieldiae	ci	2-3	4	18-24x24-29	*			ch	2-3	4-8	110	21-26x33-50	
UREDO													
apludae	y-g?	cr	4	21-30 diam.									
aristidae-acutiflorae	g-ci	2-3	2	20-24x24-26									
isachnes	y-ci	2	3	19-26x20-35									
phragmites-karkae	h-y	4.5	3-5	18-20x22-29									
UROMYCES													
aeluropodis-repentis	y-g	2-3	3-4	18-24x21-28	*			g-ch	2-3.5	4-8	100	16-24x23-40	
andropogonis	g-ci	2-3	3-4	13-17x16-19	*			ch	1.5-2	5-9	65	14-18x20-29	
archerianus	g-ci	2-3	2-3	19-23x22-28	*			ch	2-3.5	6-8	120	18-25x25-30	
inayati	g	2.5-3	3-4	15-18x16-20	*			ch	1.5-2.5	4-7	30	17-21x19-24	
superfluus	h-g	2-3	3-4	16-20x18-22	*			ch	2-3	5-8	70	18-23x22-26	III spores minutely verrucose or smooth
vossiae	ci-ch	1.5-2	3-4	16-22x21-27	*			ch	2-3	6-8	50	20-23x23-29	amphispores formed

	Urediospores				Telia			Teliospores					
Species	Wall Color	Side Wall	Pores	Spore Size	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
PUCCINIA													
aristidae	g	3-5	3-5	18-24x19-33	*			ch	2-4	6-10	130	18-29x30-50	pores also equatorial
leptochloae	g-ci	1.5-2.5	4-6	16-24x19-26	*			ch	2-3	4-7	95	17-24x25-34	
morigera	g-ci	2-3	6-7	18-23x19-26	*			ch	2-3.5	6-9	90	21-24x30-46	
polliniae-quadrinervis	ci	2.5	7-9	26-30 diam.	*			ch	3-3.5	5-7	60	23-26x30-36	II spores verrucose with rod-like papillae
pseudoatra	g-ci	2.5-3	7-8	22-26x23-27	*			ch	2-3	5-8	80	21-26x29-37	
setariae	g-ci	2.5-3.5	7-8	25-29x29-34	*			ch	3-5	8-11	90	24-32x37-48	
windsoriae	ci	1.5-2	5-6	20-26x24-31	*			ch	2-2.5	4-7	70	16-23x29-43	
opuntiae	g-ci	2-2.5	6-8	19-26x20-26	*			ch	2-2.5	4-9	80	19-26x26-45	
UREDO													
chascolytri	y	1.5-2	6-8	20-25x23-32									
danthoniae	ci	?	?	14-20x17-22									
susica	g	2	3-5	18-25x21-26									
UROMYCES													
agropyri	ci?	?	4-5	19-20x21-23	*			g?	?	much	25?	16-18x28-37	
mussooriensis	y-g	2-2.5	3-5	16-21x20-25	*			g-ch	1.5-2.5	5-7	65	17-22x23-26	pores may be equatorial
peckianus	y-g	2.5-3	5-6	16-23x18-25	*			g-ch	1.5-3	4-10	100	16-21x24-35	

GROUP IX: UREDIA UNKNOWN OR LACKING; CHARACTERS UNCERTAIN, etc.

Species	Urediospores	Nak	Cov	Par	Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
PUCCINIA										
abei	not described	*			g-ch	3.5	3.5-4	300	19-25x43-70	
amianthina	not described	*			g?	2.5-3	2.5-3	70	17-25x22-36	
asperellae-japonicae	not described	*			ch	1.5-2.5	5-17	150	13-20x35-66	coronate but not related to P. coronata
bewsiae	not described	*			g-ch	2.5-3.5	5-7	90	24-29x34-39	
avocensis	probably lacking	*			g-ch	3-4	3-5	120	25-28x37-44	
festucae-ovinae	not described	*			ch	1-1.5	3-4	60	16-22x28-43	
fushunensis	not described	*			ch	?	?	70	16-22x23-30	
gracilenta	not described	*			h-y	1	3-6	20?	6-10x25-40	
graminella	lacking	*			ch	2-3.5	8-23	200	20-30x40-60	autoecious; III spores germinating p.p.
interveniens	lacking	*			g-ch	2-3	6-18	200	20-30x40-65	III spores germinating p.p.
miscanthicola	not described	*			ch	2-3	4	190	15-24x32-55	may be a variant of P. erythropus, sometimes 3- or 4-celled.
mitriformis	not described	*			y-g	2-3	25-84	250	16-24x58-130	III spores minutely verruculose
neyraudiae	not described	*			ch?	2-2.5?	3-6	90	17-25x26-37	
okatamaensis	not described	*			g-ch	1.5-2	5-11	160	12-20x42-70	
oplismeni	not described	*			ch	?	-8	80	14-21x28-38	

Species	Urediospores Wall Color	Side Wall	Pores	Spore Size	Telia Nak	Cov	Par	Teliospores Wall Color	Side Wall	Apical Wall	Ped	Spore Size	Special
panici-montanae	description not available												
phaeopoda	not described				*			ch	1.5-2	2.5-5	40	21-27x26-34	
tankuensis	not described				*			ch?	2?	-12	170	20-26x32-50	
tripsacicola	g-ci	1.5-2	1	19-26x42-66	*			ch	3-4	5-7	100	21-28x39-50	<u>Uromyces tripsaci</u>, probably amphispores of this, smooth, apex 7-10, pore basal
wolgensis	not described				*			h-g	7-10	9-12	25?	30-45x35-58	
xanthosperma	not described				*			y-g?	2?	4-10	75	16-25x42-58	
<u>UREDO</u>													
lopatheri	g	2?	?	16-20x20-28									no par., spores echinulate
panici-villosi	g-ci	1.5?	1-2?	18-24x24-30									no par., spores echinulate
poiophila	h	?	?	20-22 diam.									spores descr. as smooth, no par.
setariae-onuri			description not available										
stipae	ci?	?	?	20-25? diam.									spores descr. as smooth, no par.
uromycoides	y?	1?	?	18-20x26-28									spores descr. as minutely papillose, no par.
<u>UROMYCES</u>													
cuspidatus	may be lacking				*			h-g	1-2	8-26	130	14-22x25-64	spores germinating
ehrhartae-giganteae	not described				*			g-ch	1.5-3	5-8	160	17-23x23-37	
stipinus	not described				*			g-ci?	2?	-11	?	16-21x24-32	apex a hyaline umbo, ped.fragile

	Urediospore Size	Telia Nak.	Telia Cov.	Teliospore Size[1]	Ped.	Digit.	Source of Data
alpini-coronatae Muehlenth.	18-21x22-26		*	12-20x38-52	10	2-5	Mayor specimen
avenae-barbatae Gonz.-Frag.	16-23x24-36	*	*	12-22x36-72	15?	?	Flora Iberica
beckmanniae McAlp.	16-19x25-29		*	16-22x45-60	10	2-10	type specimen
brevicornis Ito	12-17x15-20	*		12-20x35-55	10	3-7	type specimen
corniculata Mayor et Viennot-Bourg.	19-24x22-27	*		15-22x35-48	25	5-20	type specimen
coronata Cda.	16-24x20-30		*	12-22x35-53	10	3-9	specimens
deyeuxiae Tai et Cheo	not described		*	10-13x53-75	15?	10-20	orig. description
epigejos Ito	20-26x24-32	*		14-20x45-90	10	3-12	type specimen
erikssonii Bub.	13-15x15-20	*		11-15x34-56	10	2-5	Bubak specimen
gibberosa Lagh.	21-25x24-30		*	12-18x38-55	15	2-9	Syd. Ured. No. 2723
hierochloae Ito	12-18x16-27	*		14-22x40-60	10	5-16	type specimen
himalayensis (Barcl.) Diet.	10-13x12-18	*		10-18x42-63	15	4-10	Indian specimen
lolii Niels.	16-24x20-30		*	12-22x35-52	10	3-10	specimens
mediterranea Trott.	16-17x18-25		*	12-16x40-60	10?	2-7	orig. description
melicae (Eriks.) Syd.	12-16x15-18	*		11-16x30-46	10	2-7	specimen
paniculariae Arth.	16-24x18-26		*	14-19x43-70	20	0-5	type specimen
pertenuis Ito	16-18x16-24	*		10-16x40-84	10	5-15	type specimen
poae-pratensis Miura	13-16x16-20	*		13-16x45-67	10	5-25	Miura specimen
pumilae-coronatae H. Paul	21-25x26-30		*	13-18x43-53	10	2-5	Bubak specimen
rangiferina Ito	18-23x23-28	*		12-19x50-95	10	10-30	type specimen
subdigitata Arth. et Holw.	12-15x14-19		*	10-16x38-52	15	2-5	type specimen

[1] Measurements excluding the digitations.

Appendix II

SYNONYMOUS SPECIES INCLUDED IN PUCCINIA RECONDITA

Species	Urediospore Size	Teliospore Size	Source of Data
aconiti-rubri Ludi	?	16-23x46-73	type? specimen
actaeae-agropyri E. Fisch.	18-25 diam.	14-24x32-45	orig. description
actaeae-elymi Mayor	18-23x23-26	13-18x34-48	type? specimen
adspersa Diet. et Holw.	18-23x21-28	16-21x38-50	type specimen
aegilopis Maire	20-25x26-30	15-21x43-51	specimen
agropyri Ell. et Ev.	19-23x26-32	16-21x40-65	type specimen
agropyri-junceae Kleb.	20-25x21-30	13-17x39-60	orig. description
agropyrina Eriks.	17-24x23-29	13-18x40-62	type specimen
agrostidis Plowr.	16-22x20-25	13-18x38-48	Plowr. specimen
alternans Arth.	16-21x20-24	15-24x34-43	type specimen
ammophilae Guyot	20-25x26-33	14-18x38-60	type specimen
apocrypta Ell. et Tracy	20-22x23-26	14-19x38-56	type specimen
arrhenathericola E. Fisch.	20-26x25-30	16-23x40-55	specimen
borealis Juel	18-22 diam.	13-20x35-45	Sydow Monogr.
brachypus Speg.	20-24x24-30	12-18x42-72	type specimen
brachysora Diet.	20-25x24-31	15-22x30-45	Ito Mycol. Flora
bromicola (Mains) Guyot	19-24x24-29	14-19x35-50	type? specimen
bromi-japonicae Ito	18-25x22-30	16-24x34-54	type specimen
bromi-maximi Guyot	19-24x20-30	13-20x44-65	type specimen
bromina Eriks.	20-24x24-28	14-18x36-58	specimen
cerinthes-agropyrina Tranz.	22-27 diam.	17-24x32-48	orig. description
cinerea Arth.	18-23x23-29	16-21x45-70	type specimen
clematidis-secalis Dupais	20-25x23-27	14-20x35-52	type specimen
cockerelliana Bethel	19-26x24-32	13-21x50-85	type specimen
dactylidina Bub.	20-24x22-28	15-20x38-55	type specimen
dietrichiana Tranz.	19-20 diam.	14-17x36-41	orig. description
dispersa Eriks.	22-28 diam.	12-20x40-50	orig. description
elymicola Const.	23-32x32-42	16-24x43-60	type specimen

elymi-sibericae Ito	20–22x28–32	12–18x38–65	Ito specimen
fujiensis Ito	17–22x22–29	12–17x30–55	Jap. specimen
glyceriae Ito	17–22x20–25	12–19x40–62	type specimen
haynaldiae Mayor et Viennot-Bourg.	20–24x20–29	15–20x35–55	type specimen
hierochloina Kleb.	17–22x22–25	16–23x32–45	orig. description
holcicola Guyot	22–24x24–29	18–24x40–60	type specimen
holcina Eriks.	19–24x23–27	16–24x38–58	specimen
hordei-maritimi Guyot	22–24x24–28	13–20x34–60	Guyot specimen
hordei-murini Buchw.	18–24x22–28	16–24x39–58	Arthur Manual
hordei-secalini Viennot-Bourg.	19–26x21–28	11–18x32–50	type specimen
ishikariensis Ito	18–24x20–28	14–20x38–62	type specimen
madritensis Maire	20–24x25–28	12–20x40–50	specimen
mellea Diet. et Neger	18–23x20–27	12–18x45–70	type specimen
milii-effusi Dupais	19–23x22–27	11–18x37–65	type specimen
obliterata Arth.	16–21x20–25	12–19x35–50	type specimen
narduri Gonz.- Frag.	18–20x21–28	20–25x48–60	orig. description; spec. from type loc. not similar
perminuta Arth.	15–18x16–22	10–16x28–42	type specimen
perplexans Plowr.	16–23x23–26	16–21x38–55	Plowr. specimen
persistens Plowr.	20–30 diam.	15–20x50–60	orig. description
procera Diet. et Holw.	26–32x32–48	15–23x45–74	type specimen
recondita Rob.	20–25x24–30	14–19x40–60	type specimen
ribigo-vera Wint.	17–24x20–32	16–24x26–80	orig. description
sardonensis Gaeum.	16–21x20–25	12–18x40–56	type specimen
scarlensis Gaeum.	20–23x22–25	12–17x40–60	Gaeum. specimen
subalpina Lagh.	17–22x20–26	15–20x35–49	type specimen
thalictri-distichophylli E. Fisch. et Mayor	19–23x24–28	13–19x40–62	type specimen
thalictri-koeleriae Gaeum.	21–24x23–26	10–16x45–70	Gaeum. specimen
thalictri-poarum E. Fisch. et Mayor	14–18x15–20	14–18x40–62	Mayor specimen
thulensis Lagh.	?	14–23x36–44	orig. description
triseti Eriks.	19–23x21–26	16–23x36–53	specimen
tritici-duri Viennot-Bourg.	20–31x26–36	16–22x40–60	type specimen
triticina Eriks.	19–23x23–29	14–20x30–55	Eriks. specimen
triticorum Speg.	?	11–18x40–50	orig. description

Appendix III

SYNONYMOUS SPECIES INCLUDED IN UROMYCES DACTYLIDIS

Species	Urediospore Size	Teliospore Size	Source of Data
adelphicus	?	16-20x23-29	type specimen
agrostidis (Gonz.-Frag.) Guyot	15-18x17-20	14-18x21-28	Syd., Ured. No. 855
airae-flexuosae Ferd. et Winge	18-25x23-28	16-22x27-37	Guyot specimen
alopecuri Seym.	15-20x18-25	14-20x21-27	specimens
atropodis Tranz.	17-21x20-27	16-20x27-34	type specimen
dactylidis Otth	19-24x23-29	14-19x20-28	specimens
festucae Syd.	18-24x23-27	13-19x20-32	Syd. Ured. Nos. 1356, 1502
festucae-nigricantis Gonz.-Frag.	22-24x22-27	17-20x24-29	type specimen
lygei Syd.	20-26 diam.	14-20x21-28	type specimen
phlei-michelii Cruch.	17-21x20-25	14-23x20-27	type? specimen
phyllachoroides P. Henn.	16-24x20-28	17-22x26-35	type specimen
poae Rab.	16-20x20-26	15-19x24-28	specimens
poae-alpinae Rytz	18-21x21-25	15-21x20-24	Mayor specimen
ranunculi-distichophylli Semadini	16-19x18-22	14-19x21-28	type specimen
ranunculi-festucae Jaap	18-22x20-27	14-20x27-38	type specimen
sclerochloae Tranz.	17-20x18-24	17-20x23-29	type specimen
scleropoae Baudys et Picb.	14-23x26	22x24	orig. description
triseti Katajev	23.5x26	16-22.5x22.5-33.5	orig. description
volkartii Gaeum. et Terrier	18-22x21-26	18-20x30-35	type specimen
vulpiae Camara	not described	17-20x25-30	orig. description
vulpiae Losa Espana	18x18-20	17-22x25-40	orig. description

THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

DEVELOPMENT AND PRODUCTION OF PATHOGEN FREE PROPAGATIVE MATERIAL OF ORNAMENTAL PLANTS

Supplement 238 June 15, 1956

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

Issued by

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch Plant Industry Station, Beltsville, Maryland

DEVELOPMENT AND PRODUCTION OF PATHOGEN-FREE PROPAGATIVE MATERIAL OF ORNAMENTAL PLANTS

Ornamental Crops Subcommittee[1] of the Committee on
Seed and Plant Material Certification, The American
Phytopathological Society

Plant Disease Reporter
Supplement 238

June 15, 1956

CONTENTS

[1] K. F. Baker (Chairman), J. G. Bald, P. Brierley, A. W. Dimock, E. W. Lyle, D. E. Munnecke, C. J. Olson, J. Tammen, S. Wilhelm.

I. INTRODUCTION

The activities of the new Ornamental Crops Subcommittee necessarily differ somewhat from those of the parent Committee on Seed and Plant Material Certification. Since there are almost no certification schemes in this country for this group of crops, a study of existing programs was not possible. However, it was considered worth while to study some of the methods devised for the determination, development, and production of pathogen-free propagative material of ornamental plants. This is the fundamental basis of a certification program, should one later be evolved. There is a considerable body of information, much of it unpublished, in obscure trade papers, or buried in papers on other subjects, concerning this aspect of the pathology of ornamentals.

It is the purpose of this series of papers to present selected examples of the successful production of pathogen-free stock, giving the following information for each:

1. Methods for detection of infected or infested propagative material.
2. Methods for obtaining the original stock of pathogen-free material.
3. Methods for maintaining the pathogen-free status of the stock under conditions of commercial propagation.
4. The degree of success attained in commercial practice by both the propagator and the man who finishes growing the stock for sale. Is the program economically worth while for the propagator, and does the stock enable the grower to produce better or cheaper plants than before?

It is hoped that this first attempt at such a summation will prove useful in at least the following ways:

1. To make available to floripaths, and to other pathologists who occasionally advise on diseases of commercial ornamentals, a partial summary of proven control procedures available in 1955. This may serve to focus attention on the possibility of reducing the severity of diseases of many ornamental crops to such a level that expensive control programs by the grower are reduced or rendered unnecessary. This approach is perhaps more feasible with ornamentals as a group than with most other crops. Ornamentals are grown in an isolated soil mass (e.g., pots, flats, benches, or beds) commonly treated to free it of pathogens. The recontamination hazard is reduced by the protection afforded by glasshouses and similar structures, and by the compactness of the production units, which are relatively isolated from each other. The controlled climate of the glasshouse also minimizes many diseases. Finally, the relatively high financial return from ornamental crops makes economically possible many control procedures not feasible for most vegetable, agronomic, or fruit crops. However, the treatment of propagating material also provides a method for the reduction of disease under field conditions, as is shown by the results reported for bacterial blight of stock, Heterosporium disease of nasturtium, Fusarium yellows of gladiolus, and black spot of rose.

2. To bring to the attention of other plant pathologists unfamiliar or untried techniques that might be adapted to other types of crops.

3. To make available to commercial propagators information that should enable them to incorporate some of the methods into their own programs. It is recognized that, due to man's inherent imperfections, no practical programs of the types outlined here will be faultlessly executed. However, this does not justify recommending a compromise method. The system proposed can and should be perfect.

4. To publicize proven methods for practically eliminating plant diseases in some crops, and thus indicate that eventual certification of such crops is both possible and reasonable.

An accessory benefit from the preparation of these papers was the clarification and evaluation by the several authors, of basic philosophies, objectives, and methods with respect to pathogen-free propagative material.

This series of papers has included only representative commercially tested programs. Many other schemes are being devised by pathologists or tried by growers; it was thought best not to include such commercially undemonstrated methods at this time. There are several instances of production of a pathogen-free floricultural crop that have had adequate scientific demonstration of their feasibility, but still lack commercial sponsors to place them in practical use. Publication in such a series as this would be an excellent means of bringing the possibilities to the notice of commercial propagators. However, the Subcommittee decided not to seize this attractive opportunity. Perhaps some future Committee may wish to include them in a later summation when they have become established procedures. This series of papers may then be viewed as an attempt to evolve a useful means of focusing attention on a rapidly developing, but often unrecognized, phase of phytopathology.

There are many evidences among pathologists and growers of a growing awareness of the desirability for preventing the initiation of a disease, rather than relying on spray programs to suppress it after it is established. These papers will have served their purpose if they advance this trend. For the present, a guiding principle of many floripaths with reference to diseases will continue to be, "Don't fight 'em, eliminate 'em."

II. PRODUCTION OF CHRYSANTHEMUM PROPAGATING MATERIAL FREE FROM CERTAIN MAJOR PATHOGENS

A. W. Dimock[1]

Certification of plant material is practical only when one or the other of the following possibilities exists: (a) the presence of the pathogen on or in infected material can be determined with certainty by some practical means (see below); (b) a practical method of controlling the disease in propagative material is known. We will consider here only those chrysanthemum diseases, other than viruses, to which the second of the above conditions applies. These include Septoria leafspot, foliar nematode disease, rust, Mycosphaerella ray blight, and Verticillium disease. Powdery mildew will not be treated since it presumably is caused by a nonspecific Erysiphe which occurs widely on many weed hosts, and may be controlled easily by the grower. Bacterial blight will be omitted since neither detection nor control is reliable by currently available methods.

Detection of Infected or Infested Propagative Material

From the point of view of a certification program, the detection of infected propagative material would play a part only in eliminating obviously unsatisfactory sources. The presence of any spots, flecks, or other abnormalities of the foliage would place the material under suspicion. But while the demonstration of fungus sporulation or nematodes in the abnormal tissues might definitely indicate disease, inability to demonstrate organisms would not assure the absence of spores, latent infections, or viruses. Having observed chrysanthemum diseases and chrysanthemum production rather closely for many years, the writer feels that although certification by inspection might be better than nothing, the emphasis must be on elimination of diseases at the source of plant production by the employment of the tested programs outlined below.

Methods of Obtaining Initial Pathogen-free Plants

Septoria Leafspots (S. obesa and S. chrysanthemella). -- Near-perfect control of these diseases may be achieved either under glass or in the open.

A. Under glass. Since the Septoria spores are disseminated almost exclusively by splashed water, control under glass may be achieved by eliminating splashing. Water the stock plants by subirrigation or by some method of careful surface flooding which will at no time permit splashing of the foliage. Take short tip cuttings only from shoots which have grown at least 10 to 12 inches since the start of the control program. Such cuttings will be free from Septoria infections and spores.

B. In the open or under glass. Complete control under conditions where splashing occurs may be achieved by spraying weekly with most any good fungicide. Zineb is recommended, but any other carbamate, or captan, will do as well. As soon as shoot growth begins, spray weekly with zineb at 1 pound in 100 gallons, with enough detergent to insure good wetting. Direct the spray upward so as to cover the lower surface of the leaves. This is essential. Take short cuttings from shoots which have grown at least 10 to 12 inches since the start of the spray program.

Foliar Nematode Disease (Aphelenchoides ritzema-bosi). -- May be completely controlled either under glass or in the open.

A. Under glass. Since movement of the nematodes from leaf to leaf depends upon either splashing or a film of moisture on the plants, nematode-free cuttings can be obtained by following procedure A under Septoria leafspots.

B. In the open or under glass. Two methods are possible:

1. Immunization of the Plant by Soil Treatment with Systemics.

Systemic treatment with sodium selenate: About 2 to 3 weeks after the stock plants have been planted, drench the soil of the beds with a solution containing 1 ounce pure sodium selenate crystals for each 15 gallons of water. Apply at the rate of 1 pint to each square foot (15 gallons would treat 120 square feet). After treatment, water thoroughly. Repeat treatment

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in 10 to 14 days. Take only short tip cuttings from shoots which have grown at least 6 inches following the second treatment.

Systemic treatment with demeton: Apply 1/2 pound technical demeton per 1000 square feet. The demeton (Systox) should be diluted in enough water to apply at least 1 pint of solution per square foot. After treatment, water the area thoroughly.

2. Spraying with Parathion or Demeton. Spray new growth every 10 to 14 days with parathion (1 1/2 pound 15% parathion wettable powder per 100 gallons) or with demeton (1 quart Systox per 100 gallons). Take short tip cuttings only from shoots which have grown 6 inches or more since the start of the spray program.

The spray programs have the advantage that the zineb, or other fungicide, for Septoria leafspot may be combined with the parathion or Systox, hence controlling both diseases with a single spray program.

Rust (Puccinia chrysanthemi). -- The zineb spray program outlined for Septoria leafspot will also give near-perfect control of rust. The program should be employed whether the stock plants are grown under glass or out-of-doors.

Mycosphaerella Ray Blight (M. ligulicola). -- Cuttings produced in areas where ray blight occurs might very well carry the pathogen as spores or as latent infections. The spray program suggested under Septoria leafspot would insure against this.

Verticillium Disease (V. albo-atrum). -- Near-perfect control of Verticillium disease could be achieved only if the stock plants were started from indexed cuttings and grown in sterilized soil in raised benches or concrete-bottom ground beds. An indexing procedure for establishing basic nucleus stock follows:

1. Take terminal cuttings about 6 inches long from vigorous shoots on the most healthy-appearing plants available.

2. Cut off the basal 2 inches to use for virus indexing (scion of virus indicator variety grafted to this basal segment, and portions of leaves used for juice inoculation of certain test plants).

3. Strip the leaves from the basal inch of the remaining 4-inch terminal cutting and secure similarly marked labels to the base and to the top of each cutting.

4. With a flamed scalpel or razor blade, cut off the basal inch of each cutting and immerse in a vessel containing freshly prepared Clorox solution (1 volume Clorox to 4 of water) for at least 1 minute, then remove and place on a clean paper towel.

5. When the segments have dried somewhat, cut a 1/4-inch piece from one end and discard, then cut 4 serial sections not over 1/32 inch thick from the remaining portion of the segment. While cutting, hold the segment on the spot of the towel which absorbed the excess Clorox solution. Flame the scalpel or razor blade before the first cut in each segment.

6. With a needle, transfer the 4 thin sections to a long potato dextrose agar slant in a test tube, placing one cut surface on the agar, and spacing the sections about 1/2 inch apart. To hasten results, place the tubes at 75° to 80° F (24-27°C).

7. The labeled tops of the cuttings may be handled by either storing or rooting immediately:

(a) If the tops are to be stored they should be spaced on a strip of waxed paper and rolled up, keeping the bases of the cuttings well separated. A rubber band is placed around each roll and the rolls placed in polyethylene bags at 31-34°F.

(b) Least delay in getting cuttings rooted is achieved by putting them at once in separate sterilized vials, Dixie cups, or other containers of moist, sterilized rooting medium. These may best be placed in racks under lights or in the greenhouse for rooting. The containers should have sufficient volume to retain a considerable water supply and should have tops large enough so that any required renewal of water is easy.

8. After at least 10 days examine the potato dextrose agar test tubes in good light and record the index number of all those which show any fungus or bacterial growth at any of the 4 stem slices.

9. Discard all of the cuttings which gave any growth in the tubes. Pot or bench the remaining healthy ones (after they have been indexed for virus) in sterilized soil. These mother-block plants must be in solid bottom beds or raised benches, and these must be sterilized even if pot culture is employed.

After the nucleus block has been established, cuttings may be taken from the indexed plants, without further culturing, to establish increase or production blocks. These blocks must be grown in sterilized solid-bottom ground beds or raised benches and must be frequently renewed from the indexed nucleus blocks. Each nucleus and increase mother-block plant should be permanently labeled and, if possible, the progeny of each should be planted as a labeled unit in the production block. If at any time any plant in a given unit shows symptoms of Verticillium or any other systemic disease or undesirable horticultural character, the entire unit and its mother plant should be discarded or withdrawn from production until thoroughly rechecked. Obviously, a proportion of the progeny of each nucleus plant should be allowed to flower frequently in order to insure horticultural purity of the variety.

Summary Program for All the Above Diseases. --

All stock plants for cutting production should be grown from Verticillium-indexed (and virus-indexed) nucleus blocks.

All nucleus blocks and increase blocks must be grown in sterilized solid-bottom ground beds or raised benches.

All increase blocks should be thoroughly sprayed every 7-10 days with zineb at 1 pound per 100 gallons of water.

Either the soil of the nucleus blocks and increase blocks must be treated with sodium selenate or demeton, or parathion (1 1/2 lb. 15% wettable powder per 100 gallons) or demeton (1 quart Systox per 100 gallons) must be added to every second zineb spray treatment.

For propagation, only short terminal cuttings from shoots which have grown 10 to 12 inches since the start of the control program may be used.

The rooting medium must be sterilized between each batch of cuttings.

Methods of Maintaining Disease-free Production Blocks

There should be no possibility of the Septoria or leaf nematode diseases appearing _if_ all increase block plants come through the nucleus-block program. Additional insurance would be provided by periodic zineb- parathion (or demeton) sprays. Such sprays would also insure against entry of rust or ray blight from wind-blown spores.

Continued freedom from Verticillium could be assured by constant surveillance to detect escapes, and by strict prohibition of practices which would permit recontamination of the soil. The latter would require that ends of hoses be kept off the walks at all times, that tools used in planting, cultivating, etc., be sterilized, and that neither workmen nor visitors be allowed to put their feet on the benches.

Are the Suggested Procedures Practical?

That the above procedures are practical for large propagators has been amply demonstrated by the success of one of the largest firms in the country in virtually eliminating the Septoria and nematode diseases from their stock, and reducing Verticillium from the major disease problem of the industry, to one of only occasional importance under glasshouse conditions. The fact that one or more of these diseases has occasionally reappeared in their stock when controls were relaxed is further evidence that the controls, when applied, are effective. It is significant that, although the disease control program has been very expensive, this firm has continously expanded, and other firms have instituted similar programs. For what significance it may have, it may be noted that a somewhat misguided organization, hoping to break into chrysanthemum cutting production, seriously attempted to employ a pathologist as a "front" simply because all the competitors had pathologists!

Is the expense of the program justified? Perhaps this can best be answered by the fact that a suit for $50, 000 recently was instituted against a chrysanthemum cutting distributor for introducing disease into the plaintiff's growing beds. Had the plaintiff won and had his success become widely known, could any propagator then have afforded _not_ to follow the best available disease elimination program?

Value of the Program to the Cut-flower Grower

Ability to purchase stock free of Septoria, leaf nematode, rust, and ray blight is of psychological advantage to the propagator and is not without value to the cut-flower producer. The propagator whose cuttings carry these diseases definitely loses sales to his more careful competitors. The cut-flower grower profits by not having infection sources introduced into his establishment, and thus is less likely to suffer seriously if he becomes lax in his spray program. If the grower could be sure that these diseases were not being introduced on planting stock he probably would not need to spray for them -- providing they had not been introduced previously. However, the spray program given above, which most growers should follow, would give excellent control of the four foliage and flower diseases mentioned, whether they were being introduced on the cuttings or not.

In contrast, cuttings free from Verticillium are of utmost importance, since no means of current-season control exists. If certified Verticillium-free cuttings are employed, the grower may provide positive insurance against the disease by adequate sterilization of the benches or beds. This has been amply demonstrated over the past decade -- has, in fact, reduced Verticillium to a disease of only occasional importance in greenhouse-grown chrysanthemums.

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III. DEVELOPMENT AND PRODUCTION OF VIRUS-FREE CHRYSANTHEMUM PROPAGATIVE MATERIAL

Philip Brierley[1] and C. J. Olson[2]

Prior to 1945 chrysanthemums were considered to be one important florists' crop not subject to any virus disease of major importance. Of course, aster yellows had been shown to affect mums as early as 1926 (8) and tomato spotted wilt had been recognized in chrysanthemums in Europe in 1935 (11) and later in our West Coast States. These diseases, although important in other crop plants, were too infrequent in chrysanthemums in this country to assume major importance in this crop. This picture changed radically with the appearance of chrysanthemum stunt about 1945 (4, 6). Successful control of stunt in florists' chrysanthemums stabilized the position of the propagation specialists who accomplished it. Chrysanthemum was the first florists' crop to be serviced by specialty firms who undertake to produce disease-free planting stock.

As a sequel to the research on stunt, and almost as a by-product of this work, mosaic (4, 7), rosette (2, 4), tomato aspermy (4), and flower-distortion (3) were detected in American chrysanthemums in the years 1950 to 1954. The tomato aspermy virus was first described in England in 1946 (1); this virus and the flower-distortion virus are apparently more common in European than in American chrysanthemums.

In this paper we shall describe briefly the symptoms and other characteristics useful in recognizing the virus diseases of chrysanthemums, explain how the viruses are detected and distinguished, tell what control measures are in use and how these measures are succeeding.

1. Chrysanthemum Stunt

Stunt was first recognized in 1945 (6), and became general in 1946 and alarming by 1947. The origin of the causal virus is still a mystery, but probably before it became evident in chrysanthemums it persisted in some of the several Compositae hosts which can carry it without showing symptoms. The delayed appearance or ill-defined symptoms in vegetative material permitted the stunt virus to go unnoticed until it was rampant. It was common for stock blocks to show flower symptoms of stunt in only 1 or 2 percent of the plants, but for cuttings from these to show 20 percent stunt at flowering. Such increases in stunt percentage indicate spread in spite of roguing.

Detection of Infected Plant Material. -- The most typical stunt symptom is a general reduction in size of the plant without mottling or severe distortion of any kind, but the foliage is usually paler than that of normal plants. On many varieties of chrysanthemum the symptoms are ill-defined, but a few sorts have marked symptoms which make them useful as indicators. The symptoms are recognized best during periods of rapid growth. At this stage the leaf margins of stunted plants may fail to enlarge and therefore the foliage has a drawn, upright appearance. It is common for the normal plants to have foliage with a downward reflex. Infected plants usually bloom prematurely and the normally red- or bronze-colored flowers of some varieties have a bleached appearance. In the greenhouses during winter, stunted plants may fail to flower because of their reduced vigor. Normal flowering, however, does not necessarily indicate absence of stunt.

Obtaining Disease-free Stock. -- Because the symptoms of stunt are poorly defined on many varieties and may not appear for 4-6 months following infection, most propagators now rely upon a graft-index procedure such as outlined by Brierley (2) in 1952 to produce foundation stock which is later built up to commercial level. To make this procedure effective it is necessary to isolate the plants and exercise precautions in any cutting removal and pruning. Any operation which causes wounding can transmit this highly infectious virus. Therefore all soft growth is removed with the aid of tissue paper shields and all cutting operations are done with tools which are plunged in alcohol and flamed before use on each individual plant. No insect vector is known.

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In the indexing routine as practiced by the junior writer, the graft-inoculations are made as soon as practical on the indicator variety Blazing Gold. This variety reliably produces a diffuse yellow veining in the young foliage 6 to 8 weeks after inoculation. The Mistletoe varieties, and also Dauntless and Blanche, produce a distinctive mottle in the same period. However, the mottle disappears from the Mistletoe varieties during periods of low light intensity and is almost unrecognizable in Dauntless during the summer. The variety Blanche produces mottle reliably, but all stocks available carry either mosaic virus or a combination of mosaic and rosette viruses without symptom expression. This variety is useful in detecting stunt in the presence of either or both of these viruses.

In routine practice the scion sample is taken from a newly established plant at the time of the first terminal removal (first pinch). If two indicators are grafted simultaneously, the first laterals from the pinch are used as scions. This reduces the sampling error to a minimum. Such a practice is advisable since partially infected plants do occur and complicate the indexing procedure. By means of simple splice grafts the scions are attached to the soft portion of the stems of the indicator plants just as near the growing point as the texture will permit. To prevent mechanical spread of the virus in the procedure, scions are removed with tissue paper shields, and flamed double-edge razor blades are used to make the necessary cuts. After being trimmed, the scions, while supported with tissue paper or a flamed forceps, are attached to 3/4-inch cellulose tape. The tape is then drawn loosely around the scion and the stock, and the adhesive surfaces are placed together. It is a simple matter to match cambiums on at least one side, because of the transparency of the tape. Two (1 1/2-inch) strips of tape will usually hold the scion in position after tightening by pressing the thumb and the index finger along the outside surface of the tape where the adhesive surfaces meet. In bright, warm weather a canopy of cheesecloth may be required to shield the scions for a week to 10 days. After this period the scions have usually regained turgor.

Since there is variability in the growth of the scions, and since the foliage produced by the receptor is used for interpretation of results, a check of scion survival and a choice of 2 receptor laterals closest to the graft are made 1 month after grafting. The chosen laterals are pinched to reduce height and induce expression of symptoms in the resulting growth. Plants that induce no symptoms in the receptor varieties after 3 months are propagated as foundation stock. In another procedure, the scions that induce no symptoms on the receptor varieties are removed, rooted, and used as foundation stock.

Maintaining the Disease-free Stock. -- Vigilance must be constant to prevent recontamination of the foundation stock and the plants propagated from it. Great care as to placing and assembling of materials at the time of propagation is essential. The critical period occurs when stocks are expanded to large-scale commercial production. One simple precaution consists in beginning all daily operations on selected material in the morning and moving on to the older plantings. Separate handling of cuttings removed from the newly indexed stock is essential. Building the reselected stock up to adequate size will eliminate the need for holding older exposed material to supply existing demands.

It is also necessary to maintain the stock at a high cultural level. Disease-free color reversions and other undesirable sports or mixtures are worthless. To reduce the chance of such aberrations occurring, the foundation stock must be flower-indexed periodically. The foundation planting must be as small as practical to reduce the amount of work in the indexing procedures. A single clone carried in error can produce a high percentage of undesirable plants in the expanded commercial stock. Annual indexing of the foundation stock appears necessary to maintain the high level of control required. Anything less than complete freedom from disease in the foundation stock vitiates the program of producing virus-free commercial stocks because of the highly infectious nature of the virus.

Success Attained in Practice. -- The program described has been highly effective. The sudden nationwide appearance of the disease produced an incipient panic in 1947-48. It was common to find 90 percent of the stock in a planting stunted. Since the control program was put into effect there has been a tremendous reduction in the amount of stunt in greenhouse plantings. By 1949 it was reduced to relatively minor importance in the florists' chrysanthemum industry. Increased interest in the use of chrysanthemums has paralleled the release of indexed stocks. Stunt is still prevalent in garden chrysanthemums, which are propagated by nurserymen rather than by florists. In recent years Neal Brothers of Toledo, Ohio, have been indexing the garden varieties by the methods described above. Reselected stocks of these sorts are now becoming available.

2. Chrysanthemum Mosaic

Mosaic is prevalent in chrysanthemums in this country and also in Europe (4, 5). The mosaic virus, first noticed in New York by Keller (7), is widely distributed in outdoor and florists' varieties. It is not unusual to find it present in unnamed seedling stocks prior to release. Since interest in new varieties is great and some important established varieties are evidently completely infected with mosaic virus, some propagators feel that they must tolerate it in their stocks in order to carry complete listings of the varieties in demand. As new seedling material becomes available this picture may well change.

Detection of Infected Plant Material. -- Mosaic virus does not ordinarily produce symptoms that detract from the performance of the plant. However, recent findings indicate that it may cause a brown breakdown of ray florets of varieties that show mild or no leaf symptoms. (3). Aphids can transmit the mosaic virus, but sap transmission is difficult, and very few instances of mosaic are found in indicator varieties in exposed commercial plantings of florists' varieties. This virus is infectious to petunia.

Obtaining Disease-free Stock. -- Though mosaic may pass unnoticed in many varieties it is very damaging to some. These may be used as indicators in a graft-index procedure similar to the one suggested for stunt. The Good News variety displays a graded series of symptoms, from the milder type, with only a light mottling of the leaves, to the extreme type with crinkling or dwarfing and often complete blasting of leaves and flower buds. This variation in symptoms is not fully explained, but a complex of viruses and virus strains may be involved. Infected Mistletoe, Dynamo, and Pandora varieties also produce graded degrees of veining and mottling and sometimes the foliage is completely blasted.

Maintaining Disease-free Stock. -- Under greenhouse conditions there is little difficulty in maintaining the stock mosaic-free. Rarely, a mosaic-free plant appears in propagation from mosaic-infected parent stock. Any program devised to control stunt should control mosaic provided a suitable indicator such as Mistletoe is used in graft-indexing.

Success Attained in Practice. -- Up to the present, practical control has not been difficult. Detection of mosaic in seedling stocks maintained in the greenhouse is very rare, but such stocks often give some positive mosaic reactions upon graft-indexing if they have grown outdoors for an an extended period during preliminary trials.

3. Chrysanthemum Rosette

Rosette, first described by Brierley (4) as Ivory Seagull mosaic, was noticed by chance when graft-indexing on the variety Blazing Gold was first used to eliminate stunt. It is a rare disease and the causal virus is carried without symptoms by three varieties in a collection of 1300 varieties and seedlings which are periodically indexed by the junior writer. The original detection was made on a selection of Ivory Seagull in which the rosette virus did not cause any change in performance as compared with that of the uninfected parent variety. The rosette virus has been found in samples supplied from Ohio, Michigan, New York, and Europe.

Detection of Diseased Material. -- Since rosette virus is masked in many varieties and causes severe symptoms in others, any discussion regarding detection applies only to the susceptible types now used in graft-indexing. The symptoms expressed in Blazing Gold vary from enlargement of veins to crinkling of foliage and rosetting of the terminal growth. In Good News, distinct dull yellow mottling develops after 2 months. Although mosaic-like symptoms accompany the rosette reaction, the rosette virus, unlike the mosaic virus, is not infectious to petunia (5). The reaction of Blazing Gold is distinct.

Maintaining the Disease-free Stock and Success Attained. -- Since rosette is rare and the causal virus is masked in several varieties, there is perhaps some doubt as to what degree of control is achieved. Manual transmissions are difficult. Under commercial conditions Blazing Gold often has been planted adjacent to varieties that carry rosette, but natural infections have never been observed. Therefore little trouble from this virus may be expected when stock has been indexed on Blazing Gold and precautions are taken against the spread of stunt and mosaic.

4. Tomato Aspermy

Aspermy was detected first in the United States in chrysanthemums from California. It has been indexed from chrysanthemums from Pennsylvania grown adjacent to tomatoes and has also been present in samples from Maryland, Michigan, New York, and Ohio. It is also widely distributed in Europe (4, 5) and it seems likely that it has been introduced into North America in plant materials from European sources.

Tomato plants infected with aspermy virus produce seedless fruits as well as exhibit other harmful effects. The virus, named from this characteristic, is aphid-borne and infectious to tomatoes, spinach, lettuce, pepper, and other plants, some of which it severely damages. Tobacco, petunia, and Nicotiana glutinosa have been used as test plants. Since aspermy virus may injure some varieties of chrysanthemum and is widely distributed in Europe, it seems likely that it may cause concern in America. In the present search for varieties suitable for pot plant culture, there has been considerable interest in the European varieties. It would appear that suitable indexing procedures should be employed for such material.

Detection of Infected Material. -- English workers mention flower breaking, stunting of plants, and distortions of flowers as symptoms of tomato aspermy on chrysanthemum. In the material observed in America thus far foliar symptoms are rare, but some affected varieties produce wavy ray florets and smaller blooms than normal plants. Indexing is necessary for detection of the aspermy virus.

Obtaining Disease-free Stock. -- Either petunia or tobacco is a suitable indicator. The most characteristic symptom on the Turkish tobacco variety Samsun is a yellow mottling which appears in 6 to 14 days. White etching and occasional chlorotic rings and green blisters also appear. In petunias of the variety Blue Ball the symptoms are similar.

In actual practice the entire chrysanthemum plant to be indexed is sampled by removing immature leaves from all growing points. This sample is placed in small beverage, or "shot" glasses, which may be used as individual mortars in which grinding is done with test tubes having suitably rounded bottoms. The glasses and test tubes withstand exposure to boiling or steaming. The pulverized leaf material is covered with distilled water and the slurry is immediately brushed onto young tobacco plants having 3 to 5 leaves previously dusted lightly with carborundum powder. Moistened cotton swabs are used in making abrasions on 2 half-leaves and the terminal of the plant. Commonly 3 plants are placed in a single 7-inch pot and one of these is used as an abrasion check while the others are used for inoculation. During inoculation the leaves are supported by holding several thicknesses of tissue paper against them. Appropriate discarding of plants is done to conform with results of the inoculations. When aspermy virus is found in a variety, additional plants of it are rechecked by repetition of the procedure outlined

Maintaining the Disease-free Stock and Success Attained. -- When rechecks have been made there have been no instances of positive symptoms of aspermy appearing in the plants which were negative in the first indexing. However, aspermy has been infrequently detected; 23 clones have yielded it in a 3-year period in screening approximately 1400 incoming clonal lines. The clones found infected with aspermy virus were from Pennsylvania, Ohio, Europe and Canada. Seventeen clonal lines which have been rechecked one or more times have yielded no aspermy. The procedure would appear to be adequate.

5. Aster Yellows

Since first reported by Nelson (9) and transmitted by Kunkel (8) in 1926, aster yellows has been widely observed in chrysanthemums in the United Sattes. The affected plants are severely damaged, but usually only low percentages are infected in any planting. The disease persists in perennial weeds and is transmitted by leafhoppers from these to asters and chrysanthemums planted outdoors. Actual infection of plants in greenhouses is rare or lacking, but chrysanthemums infected outdoors and later brought to a greenhouse may show aster yellows there.

Green flowers are a distinctive symptom of aster yellows in chrysanthemums. The laterals produced on diseased plants may be weak and spindly. Thin, weak basal shoots having shortened internodes are a delayed symptom on infected plants which may have flowered normally. Infected plants usually die in a few months, but cuttings from recently infected plants may show weak terminal growth and shortened internodes after setting. Propagations from typically infected plants are usually not successful and the disease tends to eliminate itself. Since the aster yellows virus is spread in nature only by leafhoppers, it does not present a serious problem in florists' chrysanthemums. In field plantings of garden varieties it can cause commercial loss. Plants infected late in the season may express no distinctive symptoms, but furnish no salable propagations. Effective control of leafhoppers is important in the field culture of chrysanthemum.

6. Tomato Spotted Wilt

Tomato spotted wilt has long been known in chrysanthemums in England (1) and has been reported also from California and Washington (4). Repeated index tests on tobacco by the senior writer have been consistently negative. Spotted wilt has thus far never been prevalent enough in American chrysanthemums to cause concern. Symptoms described by English workers include ring and line patterns, pale areas and necrotic spots in the foliage, death of stems and leaves, and also reduced growth. Symptoms are more readily expressed in young plants than older ones. Overwintering chrysanthemums may serve as a source of infective material for thrips, which carry this virus to other crops.

7. Chrysanthemum Flower Distortion

The flower-distortion virus (3, 10) is highly virulent to chrysanthemum. It occurred in White Wonder chrysanthemum free from other known viruses, received from a Pennsylvania nursery, and caused marked dwarfing and distortion of the flowers of Friendly Rival 4 months after grafting. No leaf symptoms appeared in Friendly Rival and none in leaves or flowers of Good News 4 months after grafting to White Wonder. The flower-distortion virus was recognized so recently that little is known about means of transmission or even about its prevalence in this country. We assume that flower distortion is uncommon here because no complaints of severe dwarfing and distortion of chrysanthemum blooms have come to our attention.

It seems not to be transmissible by manual methods, but its appearance in American varieties suggests that a natural agent of transmission exists here. Apparently still rare in the United States, flower distortion, like aster yellows, seems to offer a potential threat to field-grown chrysanthemums rather than to florists' chrysanthemums. Blazing Gold, the best test variety known, shows young shoots rosetted 2 to 3 months after graft-inoculations, with the tip leaves smaller and paler than normal. Large-flowered standards, such as Blazing Gold and Friendly Rival, produce small flowers shaped like an unopened bud with ray florets short, narrow, and incurved. Since Blazing Gold is already in use as a test variety for stunt and rosette viruses, the indexing procedure outlined above should screen out the flower distortion virus also.

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IV. DEVELOPMENT AND PRODUCTION OF PATHOGEN-FREE SEED OF THREE ORNAMENTAL PLANTS

Kenneth F. Baker[1]

Three diseases in which the pathogen is seed borne have been selected to illustrate variations in the techniques and in present objectives of the treatments employed. They also exemplify different types of economic loss. The first disease is destructive in both seed and cut-flower plantings in California, but is apparently rare in eastern greenhouses. The second is seldom observed in California seed fields or home yards, but is very important in plantings in rainy areas. The third is destructive in California seed fields and home plantings, and is known slightly in few other areas.

1. Bacterial Blight of Stocks

This disease, caused by Xanthomonas incanae (Kendr. & K. Baker) Starr & Weiss, has produced heavy losses in large commercial seed and cut-flower fields, and in home yard plantings of Matthiola incana R. Br. in California (5). While it may kill seedlings, the worst losses occur in more mature plants. The most characteristic symptom is the blackening of the leaf scars at the base of the plant.

Detection of Infected or Infested Propagative Material. -- The bacteria are carried both externally and internally by a low percentage of the seed. If one can examine the field where seed is produced (as in a certification program), it is usually possible to detect symptoms of the disease when present. However, there is some evidence that plants infected tardily and therefore externally symptomless may produce infected seed. For these reasons, it is considered safest to index uncertain seed lots by planting them in flats of steamed soil and growing in a cool place. In coastal California it is preferable to place these flats outdoors. Under favorable, cool, moist conditions the symptoms may be seen when the plants are 3-4 inches high. Laboratory methods for detecting seed-borne infection by this pathogen have not been developed, since the disease has now been reduced to commerical unimportance.

Obtaining Pathogen-free Propagative Material. -- Seed to be planted for commercial seed production is now regularly treated with hot water each year before planting. The seed is placed in plastic screen bags for treatment[2] rather than in cheesecloth as recommended earlier (5). These bags are made by double-stitching two pieces of plastic netting (15-22 meshes per inch) on three sides, and fixing a hem for a draw string at the top. All raw edges of the material should be kept on the outside of the bag to reduce sticking of seed. The bags used by various companies vary from 30 x 30 to 18 x 30 inches in size. The quantity of seed placed in the bag also varies; about 3 ounces is placed in the larger and 4 to 6 ounces in the smaller size. One company ties the top of the bags with wire rather than a draw string. Wire labels are ordinarily used to mark each bag.

The outer walls of the epidermal cells of stock seed swell and rupture when wetted, releasing their mucilaginous contents (4). Because this copiously extruded material causes wetted seeds to stick to each other and to materials on which they are placed, the hot-water treatment of stock seed is unusually difficult. However, in the plastic screen bags this troublesome feature is reduced to unimportance.

The bags of seed are plunged into a large (100-200 gal.) tank of circulating water held at 129.2°-131.0°F (54-55°C) and immediately kneaded gently with the fingers to drive out trapped air and aid penetration of water. After exactly 10 minutes the bags are removed, plunged immediately into fresh cold water, and again kneaded to facilitate rapid uniform cooling. One company then places the bags in a centrifugal drier to drive off surface moisture. The bags are then laid on a table covered with newspaper, and gently smoothed out flat to distribute the seed in a uniformly thin layer. Clean paper should be used for each lot of seed. They are then clipped on a line with clothes pins to dry in a warm room with circulating air. Avoid placing bags on hot objects or in open sun on very hot days. The seed should dry within 4-6 hours. When dry, the bags are turned inside out and any adherent seeds loosened by rubbing with the

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[2] Modified method developed by Mr. Warren F. Locke, Waller Flowerseed Co., Guadalupe, California.

fingers or with the bag. The dried seed is passed through a 6/18-inch screen and caught on a 1/16-inch screen to separate out seeds that are stuck together and let the fine chaff pass through. The adherent seeds may be separated by gently rubbing with the fingers against the screen.

Since the mucilaginous particles from the seeds easily scatter in handling, all operations involving untreated seed must be done in a building or room other than that used for the treatment, and care exercised to prevent blowing of any infested material onto treated seed. Similarly, workmen must not handle treated seed after untreated seed without carefully washing their hands. The seed should not be stored in unsterilized old used bags nor placed in storerooms with infested seed.

Maintaining the Pathogen-free Status of Propagative Material. -- The treated seed is sown in land not planted to stocks for 2, preferably 3, years. Care must be exercised that the treated seed is not used in a planter previously used for untreated seed, since the mucilaginous particles, very difficult to clean out of equipment, will cause recontamination. As an additional precaution the treated seed should be sown on sandy, rather than heavy, land so that rain water will not run from plant to plant. Ditch, rather than overhead, irrigation should be practiced.

Only single-flowered stocks produce seed, and the doubles are sterile. To maintain the required percentage of plants with double flowers, it is necessary to make single-plant selections and to grow seed from these as separate lines. Those lines with a satisfactory percent of doubles are carried through for seed, which is used in the next year to plant the production field. Single-plant selections are again made, and the rest of the seed is sold for cut-flower plantings. These facts mean that the seed from single-plant selections, of which there are often thousands, must be handled separately in heat treatment each year. In addition, the seed sown in production fields must be treated each year.

Success Attained in Practice. -- This disease formerly caused heavy losses in California seed and cut-flower fields. For example, one seed company nearly lost many of its varieties in the 1939 crop because the disease had reduced yield to a level insufficient for their own planting needs. During the past 10 years the disease has become almost rare, due largely to the above control program of seed producers. Thus, no disease has been found in the seed fields of one company during the last 5 years. Cut-flower growers have ceased treating the seed they plant. Seedsmen deserve great credit for the splendid record achieved. They are continuing to treat seed each year to maintain the disease-free status, and it is possible that the disease will essentially disappear in California.

2. Alternaria Disease of Zinnia

This disease of *Zinnia elegans* Jacq., caused by *Alternaria zinniae* Pape, is peculiar in that it causes practically no symptoms on plants in semi-arid coastal California seed fields, even though seed from them is infected by the fungus (1, 3). When this seed is planted in rainy areas, severe losses are sustained from leaf and petal spot and stem and root lesions.

Detection of Infected or Infested Propagative Material. -- It is not possible to determine by inspection whether the fungus is present in California seed fields. There is, furthermore, considerable difficulty in detecting infected seed by microscopic examination. An indexing method has, therefore, been devised (1). Seed is sown thickly (about 1000 per 18 x 18 inch flat) in soil that has been pasteurized in the flats, and is thinly covered with additional pasteurized soil. The soil is kept very wet for 20 days in the glasshouse. If the fungus is present, black lesions girdle the seedling stems at soil level or slightly above; on these lesions Alternaria may sometimes sporulate. Cotyledons frequently exhibit infections that appear to originate from the seed coat which remains attached to them for some time. This method gives a reliable means of determining infected seed lots that should be treated, but may give an exaggerated picture of the amount of infection, unless data are taken before secondary infection occurs. No laboratory indexing method has been devised.

Obtaining Pathogen-free Propagative Material. -- It has been demonstrated (1) that treatment of fresh seed with hot water will kill the pathogen without seriously reducing germination. The seed is placed loosely in cheesecloth, nylon screen, or plastic screen bags. The bags are plunged, without presoaking, into circulating hot water at 125°F (51.7°C) and promptly kneaded with the fingers to expel air bubbles. After 30 minutes the bags are removed and dipped at once into cold water, with mild kneading, to cool. The seed may then be dried in thin layers on wire screens or clean newspapers. Old seed may give marked reduction in germination. Thus, treated 1-year old seed of several varieties averaged 15.6 percent germination reduction below the checks, 2-year seed averaged 38.9 percent, and 3-year seed 78.8 percent reduction (1). The same sanitary precautions in handling and storing the seed outlined above for stock should be taken.

This treatment is largely used by seed companies for seed used to plant fields for commercial production, and by bedding plant growers who suspect that the seed used may be infested.

Maintaining the Pathogen-free Status of Propagative Material. -- The treated seed is sown in land not planted to zinnias for several years. The fields should not be near zinnias grown from infected seed or in infested soil, because of the hazard of spores being blown to the clean stock. It is necessary that the seed crop be produced in areas that are rain-free, have low humidity, and are largely free of condensation (dew) and fog during the growing and harvest seasons. For example, zinnia seed produced in the coastal and inner-coastal areas of California, in Rocky Ford, Colorado, and in Doylestown, Pennsylvania was found by indexing to be infested with A. zinniae, whereas that grown in the San Joaquin Valley, California, was free from infection (1). Planting treated seed in hot dry areas, such as the San Joaquin, Coachella, Antelope, Hemet, and Imperial Valleys, probably will produce seed crops free of Alternaria, although it is not yet certain that the yields will be as high as in cooler areas. It is also important that harvesting be completed before foggy weather and winter rains set in. Machine threshing of standing plants may give greater freedom from Alternaria, as well as "molds" such as Botrytis and Cladosporium, than will hand picking where seed heads are piled on canvas on the ground for subsequent threshing.

Success Attained in Practice. -- Several seed companies are hot-water treating the seed before it is planted in their fields. Most of the California zinnia seed fields are now in either the inner-coastal strip or in the interior valleys, and almost none remain in coastal fields. There still is some infected seed produced in fields not in an interior valley, but the trend is to produce them as far inland as economically feasible. There is some increased growing cost, due to distance from the coastal production areas of the companies.

There is no comparative data on the present and past incidence of the disease, but there is reason to believe that the fungus is less prevalent on California seed than formerly. Much more could be done if seedsmen were fully convinced of the necessity of curbing this disease in order to prevent the decline in popularity of the zinnia -- one of their "bread and butter crops".

3. Heterosporium Disease of Nasturtium

This disease of Tropaeolum majus L., caused by Heterosporium tropaeoli Bond, formerly caused severe losses in seed fields in coastal California. It produces yellowing and death of the leaves after mid-season and thus reduces yield (2). Outside of California the disease has been reported only from New York, Guatemala, Ceylon, Tanganyika Territory, New South Wales, and Mauritius. Since the disease apparently is of economic importance only in California, control procedures have centered on reduction of losses in seed fields, and only secondarily on production of pathogen-free seed for the market. The techniques used for reducing losses in the seed fields would, however, be applicable should a demand develop for pathogen-free seed.

Detection of Infected or Infested Propagative Material. -- The presence of this disease may easily be detected in the seed fields. Inspection of the seed to determine the presence of the fungus is difficult because other fungi (e.g., Alternaria) also commonly cause black discolored areas of the pericarp. An indexing method similar to that used for Alternaria zinniae was devised (2) to determine whether seed lots are infected. Pasteurized soil in a flat is planted with 100 seeds and kept very moist in a glasshouse. Small infected seedlings will die in 2-3 weeks, and in 3-5 weeks stem lesions develop on larger plants. The number of infected dead seeds is not indicated in this test, and data must be taken before secondary infections occur. The total number of infected seeds, germinable or dead, can be determined in the laboratory by placing them on sterile, moist, finely ground black peat held under fluctuating temperatures, and observing Heterosporium sporulation on the pericarp.

Obtaining Pathogen-free Propagative Material. -- The pathogen may be eradicated from the seed by the use of a hot-water treatment (2). Seed is soaked in cool tap water in large galvanized cans for 1 hour in order to displace the air between the loose pericarp and the seed. Weighted screens are placed over them to prevent floating. As there is marked swelling of the seed, the cans should not be more than two-thirds full. The water is drained off and the seed placed in wire or plastic screen boxes that are plunged into a large tank of circulating water held at 125°F (51.7°C) and frequently turned over during the 30-minute treatment. The containers are then removed and immediately cooled by flooding with tap water. The seed is then spread out in thin layers on screens to dry outdoors or in a heated room or dehydrator. Drying should be accomplished in 12-20 hours without overheating. An average germination loss of 2.9 percent (ranging from a 29.0 percent reduction in 3-year-old seed to an apparent increase of 12.8 percent in one lot) was found in 13 lots of seed experimentally treated. A commercial seed company treated 1650 pounds of seed of 29 lots with an average germination reduction of 6.3 percent and a maximum loss of 32.5 percent in one lot. Germination loss from the treatment has been negligible in the decade that it has been used by seed producers.

Maintaining the Pathogen-free Status of Propagative Material. -- Seed companies have utilized the hot-water treatment as one means of breaking the fungus carry-over cycle. This is possible because: (a) the fungus is limited to a single host; (b) the pathogen survives in soil only for about a year or until plant parts have decomposed; (c) a 1-4 year rotation is commonly practiced to eliminate volunteer nasturtiums from carry-over seed; (d) there is ample opportunity for planting treated seed in isolated fields. Since the crop is highly sensitive to both frost and high temperatures, and must therefore be grown in the coastal strip, control by selecting inland areas free from fog and dew is precluded. It is important, therefore, to eliminate the inoculum by isolation, seed treatment, and by careful removal of nasturtiums as weeds in nearby uncultivated fields and as ornamentals in adjacent home yards. Experience has indicated that satisfactory commercial control of the disease may be obtained in production fields by seed treatment in alternate years. By treatment of the seed each year and careful attention to isolation, the present limited control could be changed to the production of pathogen-free seed.

Success Attained in Practice. -- The hot-water treatment of seed planted for production is presently practiced by three companies. The leaf-blight phase has been almost completely controlled in plants grown from treated seed under isolated conditions, with development of only a few scattering late-season leafspots from air-borne inoculum. Even in some inadequately isolated fields the appearance of the disease was so delayed that it did not become a serious problem. With adequate isolation and rotation practices, plus treatment of the seed each year, there is no question but that pathogen-free seed could be produced.

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V. CONTROL OF CARNATION DISEASES THROUGH THE CULTURED-CUTTING TECHNIQUE

James Tammen, R. R. Baker, and W. D. Holley[1]

The causal organisms of two of the most devastating diseases of carnations, Fusarium wilt (Fusarium oxysporum f. dianthi) and bacterial wilt (Pseudomonas caryophylli), are systemic in the vascular system of the hosts (3, 4). Hence control of these diseases depends not upon sprays, dusts or chemical dips, but upon use of pathogen-free[2] propagative material.

Many of the early commercial carnation growers and plant pathologists sensed this fact, and recommended the selection of propagative material from symptomless plants which were far removed from disease centers. This method of selecting for disease-free stock, coupled with sanitary measures and soil fumigation or sterilization, was often successful and is used with fair success to the present time. The fact that the carnation plant may harbor these two organisms without showing either external or internal symptoms indicates, however, that disease control by the method of plant selection will be limited and in many cases ineffectual.

Recognizing the need of the carnation industry for a method that would eliminate both the Fusarium and bacterial wilt pathogens, rather than merely reduce the damage inflicted by them, Dimock (6) suggested application of the principle used previously (5) for the development of Verticillium-free chrysanthemum stock: the culturing of cuttings. This method, variously modified, was tried by a number of workers (1, 7, 8, 9, 10, 11, 12) and is presently used in certain carnation-producing areas in the United States and Europe for obtaining an original stock free from the systemic pathogens. It is easily followed, yet exacting in its requirements for handling the cuttings to be cultured and the pathogen-free stock after culturing. Competent, responsible personnel and strict adherence to the basic outlined procedures are essential to its efficacy.

Since culturing is a rather specialized technical operation calling for meticulous care, commercial flower growers have not achieved maximum success with its use. Though there is no real reason why such growers could not carry out the program successfully, it may be found best to leave the culturing of cuttings to specialist propagators, as is presently done with chrysanthemums.

Detection of Infected Propagative Material

Obtaining Original Cuttings. -- Alternaria branch rot, Heterosporium leafspot, rust, Fusarium stem-rot, and similar diseases usually may be detected and eliminated visually in any but the initial stages. Because of the difficulty of detecting affected plants in the early stages of infection, however, the stock from which the original cuttings will be taken must be grown under conditions which will eliminate or at least minimize these non-systemic diseases. Thus, the relative humidity in the greenhouse should be kept below the condensation level by increasing heat and opening vents when sudden drops in temperature occur. All wetting of the foliage, such as splashing while watering, should be avoided. Weekly protectant sprays of zineb (zinc ethylene bisdithio-carbamate) or captan (N-trichloromethylmercapto-4-cyclohexene-1, 2-dicarboximide) will also aid in the prevention of these diseases.

It cannot be overemphasized that the elimination of parasites within the cuttings does not guarantee pathogen-free stock because pathogens may also be carried on the outside of cuttings. This method of carry-over appears, for example, to be quite important in the development of Fusarium stem rot (1). Therefore, the plants from which cuttings are obtained should be periodically sprayed with captan. In some cases cuttings may carry so much inoculum that a 5-minute dip in a solution composed of 5 millileters of commercial Clorox in 95 milleters of water

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[2] Throughout this paper the term "pathogen-free" is used to mean free from specific stem and leaf pathogens such as Alternaria dianthi, A. dianthicola, Uromyces caryophylli, Heterosporium echinulatum, and Fusarium roseum f. cerealis, as well as free from systemic fungus and bacterial pathogens.

is necessary (2). Every precaution must be exercised in the ensuing propagative procedure, however, as this treatment is slightly phytotoxic.

Cuttings which are to be cultured should be broken, not cut, from the parent plant. A portion of each cutting will be used in culturing, so a cutting about 1 1/2-2 inches longer than normally selected for propagation should be taken. Cuttings taken from somewhat hardened plants are more satisfactory for culturing than those from plants which are too soft or succulent.

Immediately upon removing the cuttings from the parent plant, place them in a clean, dry, polyethylene bag. Do not at any time put cuttings into, or sprinkle them with, water. Such treatment may lead to uptake of saprophytic bacteria in the vascular system, with the result that cuttings may be unnecessarily discarded because of bacterial growth which develops in the cultures. Cuttings may be stored at 31°-40°F in the polyethylene bags for a short period before culturing.

The Culturing Procedure. -- The culturing procedure should be carried on in a dust-proof room well isolated from areas in which plants or cut flowers are handled. The room should be atomized with thymol 1-1000 before each culturing session. There are two general methods of handling the cuttings during the culturing procedure.

In the storage method, each cutting is numbered and the basal 1 1/2 inches is removed with a flamed scalpel[3] for culturing. The cuttings are then submerged in a solution of sodium hypochlorite containing 0.26 percent available chlorine (a 5% solution of fresh Clorox) for 5 minutes. They are then removed, aerated for 30 minutes, and stored in clean, dry, polyethylene bags at 31°-40°F. The hypochlorite treatment has been shown (2) to reduce the occurrence of Fusarium stem rot due to F. roseum f. cerealis (12). The cuttings should be kept separated by spacing them on a strip of waxed paper somewhat wider than the length of the cuttings. The paper should be rolled into a loose bundle with a rubber band around it before being placed in the storage bag. When the broth tubes (see below) are examined 10 days later, all cuttings corresponding to contaminated cultures are destroyed. The base of each cutting is broken off before rooting, to reduce the deleterious effect of the chemical. Thus, only clean cuttings are rooted in the sterile perlite-sand mixture.

In the paper cup method, the basal 1 1/2 inches is removed from the cutting with a flamed scalpel[3] for culturing. The remainder of the cutting is inserted in a sterile moist perlite-sand mixture in a numbered Dixie cup or similar waxed paper cup with 3 holes punched in the bottom. Each basal piece of cutting is numbered to correspond to the cup into which the cutting is placed. The cuttings in the paper cups are placed in racks in the greenhouse, and are not permitted to dry out during the rooting period. These bench-type wooden racks are fabricated with holes somewhat smaller than the top of the cups and spaced far enough apart that the cups are well separated. The sides of the rack should be high enough to keep the cup bases from touching the frame. The position of a given cup in the racks should correspond to that of the appropriate culture tube in a wire frame, to reduce errors in labelling. Care must be exercised when watering the cups so that there is no splashing. Readings are made on the broth tubes (see below) when the cuttings are adequately rooted, and all cuttings which correspond to contaminated cultures are destroyed.

With either method, the basal 1 1/2-inch piece which had been removed is placed in a small glass or beaker containing a sodium hypochlorite solution of about 1% available chlorine (20 millileters commercial Clorox in 80 millileters water) for 5 minutes. The piece is then removed from the solution and placed on a paper towel to drain for a few minutes. A 1/4-inch piece is then cut from one end and discarded, 2 slices 1/32 inch thick are cut and retained; another 1/4-inch piece is then cut off and discarded and 2 more 1/32-inch pieces are cut and retained. The 4 thin sections should be cut and held in areas of the paper toweling onto which the excess Clorox has drained. They are then transferred with a flamed, long-handled needle into a test tube containing sterile Bacto Nutrient Broth plus 1.5% glucose. The broth method of culturing cuttings is at present used in Denmark (10) and current tests[4] indicate that it is more sensitive for the detection of bacterial infections than the previously used potato dextrose agar slants or plates.

The test tubes containing the stem sections are given numbers identical to the cuttings from which they were removed. They are then stored at room temperature and agitated slight-

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[3] All implements used in this procedure must be sterilized by dipping in alcohol and flaming prior to use on each different cutting being cultured.

[4] Personal correspondence with Paul E. Nelson, Assistant Professor of Plant Pathology, Cornell University, Ornamentals Research Laboratory, Farmingdale, New York.

ly every few days for 10 days or until the cuttings in the paper cups are rooted. At this time each tube is carefully examined, preferably with a dissecting microscope. If any tube shows evidence of either fungus development or bacterial turbidity, the number is noted and the corresponding cutting destroyed. Even if the growth is obviously a contaminant, the cutting should be destroyed, since the contaminant may be producing a volatile or diffusible antibiotic which restricts growth of the pathogen sought. Cuttings are retained only if the tubes are entirely free of fungus or bacterial growth.

Maintenance of the Pathogen-free Status of Propagative Stock

As it is not feasible to use a cultured cutting for each plant in commercial flower production, the mother-block system of propagation has become increasingly popular among carnation growers. By this system a large supply of pathogen-free cuttings may be continously available from a small number of cultured cuttings. Two types of mother blocks, the nucleus block and the increase block, are used in these operations. They must be clearly distinguished. The progressive flow of propagative stock is in one direction only, once the system is in operation:

(a) Initiating the operation.

Healthiest plants obtainable → Cultured cuttings → Nucleus block → Increase block → Production plantings

(b) Continuing the operation.

Nucleus block → Increase block → Production plantings

Nucleus block → Cultured cuttings → Nucleus block

The commercial production of flowers and the production of pathogen-free nucleus stock at least, if not the increase block as well, must be handled as separate operations not utilized for cut-flower harvest.

The Nucleus Block. -- This consists of a small number of plants grown directly from cultured cuttings in an isolated area and handled with infinite care to avoid reinfection. The glasshouse containing the nucleus block should be accessible to only a few reliable persons. If a relatively small number of production cuttings are needed, the nucleus block may directly produce the rooted cuttings planted for flower production. In larger operations, cuttings from it are grown in an increase block. Because of the small size of the nucleus block, it is easily checked for disease and undesirable mutations.

The nucleus stock may be grown in large pots placed on concrete blocks on the glasshouse floor (Fig. 1). In steaming such an arrangement, a plastic cover is placed over the pots and blocks on the floor. The pots may be placed on a glasshouse bench, but should then be placed on inverted pots. Each cultured plant is thus maintained as a single unit. Should a plant become diseased, it may be removed and destroyed, with little chance of infection of surrounding plants. Soil and containers must be sterilized in all cases. All equipment used in handling and planting the nucleus and increase blocks should be sterilized before use. If watering is by hose, the nozzle should never touch the soil, either in the benches or under them. Periodic checks should be made of the nucleus block in order to ascertain their freedom from the vascular pathogens. If, upon culturing, infected plants are discovered, they should be destroyed.

The Increase Block. -- In this the cuttings to be sold or to be planted for flower production are produced. An increase block is planted only with cuttings from the nucleus block. It is larger than the nucleus block and generally is less carefully shielded from reinfection. It must be given every economically feasible protection, however, if the program is to be successful. To facilitate later checking for disease and for genetic purity, groups of plants in the increase block derived from a given nucleus plant should be kept together as a unit and numbered the same

Fig. 1. Nucleus carnation stock in a Colorado glasshouse. Each plant is in a separate pot on an individual concrete block on the concrete floor. In steaming, the whole series is covered by a tarp.

as the nucleus plant. Mechanical barriers may be used between selection units so that any pathogens carried in or reintroduced may be localized.

The increase blocks are planted directly in benches and as a rule a spacing of 8 x 8 inches is best. A greater yield of cuttings in late plantings may be obtained from a 6 x 8 inch spacing. The first crop of cuttings may be soft due to extreme vigor of the plants; decreased watering will reduce this tendency. Cuttings should be broken off above the second pair of basal leaves, so as to leave 2 growing points for future cutting production. No heel cuttings should be taken until about 2 months before the block is discarded.

Plants in the increase block (foundation stock) must be scrutinized carefully for mutations or sports. It is essential that each plant flower so that undesirable individuals or clones can be eliminated. This may be accomplished by three different methods.

(a) The performance of each plant can be checked by letting the 2 top breaks flower after the first pinch. While these are producing flowers, the lower breaks should be pinched to produce a heavy plant. Plants which produce faded, hollow-center, off-color, or small flowers should be discarded. Grassy or vegetative individuals must be eliminated. Under this system the 2 top breaks of the plants of the increase block will have flowered, and cuttings can be taken 4 1/2 months after benching.

(b) In intensive and critical operations, plants derived from each clone in the foundation stock may flower in small blocks over a year's time. Careful records on the performance of these plants can supply a basis for the elimination of undesirable individuals in the nucleus stock.

(c) A third method is now commercially used, but is highly undesirable. In some sections of the country, abundant cutting production is desired beginning in January. Increase-block plants are allowed to flower for the Christmas market and are then utilized for propagative material. In Colorado, flowers may be produced for this market from a single pinch if plants are benched in mid-June. An essential practice in this system involves the pinching of any breaks in November which will not flower by Christmas. Cuttings from such a pinch can be taken for rooting in January. The inherent defect in this method lies in the mixing of commercial flower production and the propagation of pathogen-free cuttings. Neither is likely to be adequately handled.

Periodic checks should be made on the health of plants in the increase block. About 10 percent of each flush of cuttings from each clone unit should be cultured. If an individual plant gives a positive reading it should be rechecked, and if still positive should be discarded. If more than one plant in a clone unit remained positive on rechecking, the entire clone unit and its nucleus plant should be renewed.

Commercial Feasibility of the Program

To a commercial carnation producer losing 10 to 20 percent of his marketable flower crop from disease, there can be no question as to the need of pathogen-free stock. Culturing in itself will not completely eliminate the Fusarium and bacterial wilt organisms from commercial plantings. However, it has been demonstrated that losses due to these two diseases can be reduced to a negligible level by culturing, when coupled with proper cultural practices. It must be recognized, however, that lack of care in the culturing procedure, improper care of mother blocks, or the use of incompetent personnel will spell disaster.

The cost of a culturing program will vary over wide limits depending upon the efficiency of the personnel, volume of stock needed for indexing, and percentage of stock which is originally free from disease. Some idea, however, of the probable cost of such a program as performed by competent personnel may be obtained from the following data:

Making up and sterilizing broth	Man hours per 500 cuttings
Making up and sterilizing broth	2-3
Culturing	8-12
Examination of sections in tubes	1-2
Washing of glassware	2-3
Total	13-20

The expense of such a culturing program is additional to the usual cost of producing cuttings. In Colorado it is estimated that commercial production of a carnation cutting costs about $.03, and $.02 additional to root it. Figures on the total cost of producing a pathogen-free cutting are not available.

In considering the program, it should be borne in mind that, in addition to the potentialities for disease control, there are other tangible benefits of the cultured mother-block system. Experience has demonstrated the following advantages:

1. Cuttings produced from increase-block plants are more vigorous than those from flowering plants, due to better light and nutritional conditions, as well as freedom from disease. The increased use of stored cuttings makes this an even more important point.
2. Cuttings taken from increase blocks are more uniform, and are more easily taken and prepared than are those taken from flowering stock. One commercial operator has stated that the man-hours saved in such a system pays for the area diverted to increase-block population.
3. The nucleus blocks and increase blocks can be scrutinized carefully for undesirable growth characteristics, and "running out" of varieties can thus be prevented.

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VI. PROGRESS IN THE DEVELOPMENT AND PRODUCTION OF VIRUS-FREE CARNATION VARIETIES

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Diseases of the carnation remain an economic problem even though cultural practices tend toward controlled continuous cultivation of the crop under glass, rather than the traditional method of growing plants in the field for the summer and then resetting in the greenhouse for flowering. Among these troubles are the ever-present virus diseases, mosaic, streak, and the more damaging yellows caused by a combination of the streak and mosaic viruses. These diseases exemplify different types of economic loss. Mosaic does not affect the productivity (5, 11) but reduces the quality of flowers produced. Streak lowers productivity without marked reduction in quality (4). Yellows is destructive to plants wherever carnations are grown. The identity and properties of the carnation viruses are still uncertain (1, 2, 3, 4, 6, 7, 9, 12, 13). The terminology used here is a tentative working interpretation of available information.

Growers generally still tend to accept these virus diseases in their plants. Plant breeders are interested in retaining the virus-free status of their seedling material for future propagation. Floripaths, on the other hand, may search for virus-free plants in existing commercial varieties to use as a foundation for their rehabilitation.

1. Mosaic

This disease, caused by the carnation mosaic virus, has reduced quality of flowers in commercial plantings (5, 11). It does not kill plants but affects the foliage and blooms.

Detection of Infected Plants. -- The most characteristic symptom is a slight mottling of the leaves, with light green, irregular to elongate blotches prominent during cool periods. The symptom can be more readily detected by using diffuse, strong, transmitted light on young foliage. Flowers of colored varieties, especially dark pink and red, may show a color breaking on the petals. The breaking consists of somewhat lighter streaks of the base color parallel to the veins. Since the mosaic symptoms are masked in warm weather and some varieties show few dependable symptoms, it is considered safest to index cuttings. Indexing for carnation mosaic virus in the United States was not practiced by commercial propagators prior to 1952.

Obtaining Virus-free Propagative Material. -- New seedlings are free from the virus. Three methods have been devised for recognition of mosaic-infected plants: bioassay indexing, serological indexing (9, 12), and ultraviolet radiation indexing (10). Only the first has been tested by us and is reported here.

Yoder Brothers Inc. of Barberton, Ohio initiated an indexing program employing carborundum inoculation of the *Dianthus* species reported by Brierley and Smith (2) to be good indicator plants. *Dianthus barbatus* L. (Sweet William) is commonly used, but results obtained in comparative trials by the junior author indicated that *D. superbus* L. is a more sensitive indicator species.

The prodedure used to index a stock of approximately 900 clonal lines was as follows: Three seedlings of *Dianthus superbus* and 3 of *D. barbatus* were planted in each pot of steamed soil. In each cluster, 2 plants of each species were inoculated with sap extracted from individual carnation plants when they had 4 to 5 fully developed leaves. One plant of each species was retained as a check to determine the amount of accidental spread of mosaic in the testing procedure. The sample of tissue used for inoculation was removed by pulling 5 to 10 immature terminal leaves with a forceps which had been dipped in alcohol and flamed. Samples were thus selected to weigh approximately 1 gram. The leaf sample obtained was pushed to the bottom of a "shot" size beverage glass and macerated with a test tube. About 1 millileter of distilled water was added to the macerated tissue. This test inoculum was brushed, with a sterile cotton-tipped applicator, over two leaves and the terminal portion of a seedling which had been dusted with carborundum powder. The leaves were supported during inoculation by holding several layers of tissue

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paper under them. The paper was discarded after inoculations from a given source plant.

Dianthus barbatus produced some local lesions in 5 to 7 days, and systemic symptoms in new growth in 10 to 12 days. A selected line of D. superbus was favored because of its reliability in producing systemic symptoms in 14 to 21 days. In 1953, 7 positive reactors were found out of 730 clones. When incompletely positive readings were obtained in an inoculation series, the carnation variety was re-indexed. In such a repeat index of 20 plants, there were 12 cases in which D. barbatus failed to react but D. superbus gave 2 positive reactions in the same set of indicator clusters. In samples of 2 plants both indicators gave positive reactions, and in 6 cases, 1 D. barbatus seedling of the inoculation cluster yielded symptoms. Eight infected carnation plants out of 20 were revealed by D. barbatus, against 4 for D. superbus.

In 1954, 210 individual carnation plants suspected of carrying virus were indexed. In 80 inoculated clusters D. barbatus failed to react, while in the parallel inoculation series on the selected D. superbus, 1 or 2 seedlings of the cluster gave a positive reaction. In another 66 inoculated clusters, 2 inoculated seedlings of the D. superbus clusters reacted with systemic symptoms and in D. barbatus inoculated with similar virus isolates only 1 seedling per cluster gave positive reaction. Fifty-seven isolates gave positive reactions on both Dianthus indicators. Only in 7 cases did D. barbatus react more quickly than D. superbus. Of the total 420 D. barbatus plants used in the inoculation test, 175 positive readings were obtained; 109 local lesions; 64 systemic; 2 both local and systemic symptoms. Only 130 infected carnation plants were revealed by D. barbatus, against 210 for D. superbus.

Results indicate the need of uniform indicator plants. D. superbus proved more reliable and less erratic in manifestation of systemic mottle symptoms.

Maintaining Disease-free Stock. -- Extreme precautions against manual spread of the virus have been exercised during the last 2 years. It is suggested that plant foliage be dry during the removal of cuttings with paper shields. Flamed instruments should also be used for all pruning or disbudding in the isolation blocks. Even with these precautions, in a large commercial operation mosaic spread to 5 seedling blocks in a period of 18 months. However, no effort was made to eliminate mosaic from existing commercial propagative plantings because of the necessity of growing the varieties adjacent to infected stock. Florists presently grow the virus-free plants among infected ones and thus nullify the previous care. The maintenance of virus-free foundation stock by these methods would appear to be practical, however (see below). The full benefit from this program will come when growers are ready to capitalize on it by proper isolation and careful handling. It is considered that when a suitable collection of virus-free varieties are assembled, it should be practical to grow such a group under isolation for an extended period of time to retard the re-infection with mosaic. Because the virus is transmissible by the peach aphid (3), careful aphid control must be practiced in the disease-free stock.

Degree of Control Achieved by Bioassay Program. -- In 1952 the first screening for the presence of carnation mosaic virus included 41 varieties and seedlings which were represented by 275 clonal lines. In the first index, 140 clones gave positive readings. The 135 clones which gave negative results on the first index were rechecked and 17 positive reactions were obtained, giving a total of 57.09 percent virus infection of the original clones. From these results it would seem advisable to recheck virus-free selections from the bioassay indexing shortly after the initial tests to prevent the maintenance of any infected escapes.

In 1953 the clones were re-indexed, and no positive readings were obtained. The 1954 recheck yielded 3 questionable reactions. These results indicate that it is possible to select mosaic-free stock by this bioassay indexing and to maintain it virus-free in a mother block by isolation and annual indexing. It seems clear that this success can be carried on into large propagation blocks when there is sufficient commercial demand for such virus-free stock. For the present, a basic virus-free stock of new seedling varieties is being maintained.

2. Streak

Jones (6) identified streak as a component of the carnation yellows complex in 1945. This virus is not so widely spread as mosaic but is more damaging in its effects. Parts of Creager's (4) report on carnation mosaic were interpreted by Jones to be concerned with the streak virus. In the light of Jones' study, Creager (4) reported that streak reduced the flower cut in King Cardinal variety by 19 percent with a further reduction in quality of flowers. Lowered productivity is the main basis for interest in this virus (2). Natural infection of up to 30 percent under field conditions in the variety King Cardinal was reported (4). Jones (6) reported the aphid, Myzus persicae Sulz., as the vector of carnation streak virus. Brierley and Smith (2) in 1947 stated "that we have been unable thus far to confirm Dr. Jones' conclusions that the green peach aphis transmits streak, but some insect more common in the field than in the greenhouse is evidently the agent of spread".

Detection of Infected Plants. -- The typical symptom is the appearance of white, yellowish brown, or purplish broken lines or streaks in the leaves, usually paralleling the veins. They are plainly expressed in old leaves of established plants in the spring, especially from March to May. Many of the older leaves thus infected may become severely spotted, turn yellow, and die. The streak virus appears to produce no distinguishing symptom on the flower.

Obtaining Disease-free Plant Material -- New seedlings are free from the virus. The chrysanthemum graft-indexing procedure has been adapted to select plants free from streak virus, whether it is alone or combined with mosaic. Splice-grafting resulted in 60 to 80 percent successful union, with reliable expression of symptoms in 2 months during spring or fall when greenhouse night temperatures were maintained at 60°F.

Seedling No. 115 was selected as the indicator for graft indexing following a screening of 79 varieties and seedlings for ability to express yellows and mosaic when grafted with diseased scions. The method of grafting and the procedure parallels the one described elsewhere in this series by Brierley and Olson for detection of chrysanthemum viruses. The only modification is that a nodal portion of the stem of stock and scion is selected for the graft union. Expression of symptoms usually occurs in 60 days.

Brierley and Smith (2) suggested the following program for obtaining disease-free stock:

a. Selective roguing during the spring months when symptoms are most marked.
b. The selection of streak-free cuttings and maintaining such blocks under glasshouse cultivation.
c. Maintenance of effective insect control by fumigation, sprays, or dust insecticides.
d. Reselection in foundation blocks.
e. Renewal of foundation blocks with cuttings from streak-free plants.

Maintaining the Disease-free Stock. -- Since the streak virus is not mechanically transmitted, the main control measure is adequate insect control. The present-day insecticides, applied as aerosols, systemic sprays, or dusts, have effectively controlled the potential vectors. There is essentially no increase of streak in greenhouses with efficient insect control. Isolation of foundation blocks also effectively prevents the introduction of the mosaic virus into the planting.

Degree of Control Achieved. -- Such a program maintained at Yoder Brothers has proved to be very effective in the production of streak-free varieties.

3. Carnation Yellows

Carnation yellows, caused by a combination of mosaic and streak viruses, is the most destructive of the carnation virus diseases. The disease produces loss of plants in addition to the decreased productivity and lowered quality of blooms.

Detection of Infected Plants. -- Yellows-affected plants show mottling and flecking of leaves and stems, distortion, and color breaking of the flowers. Young leaves show light and dark green mottle, and older leaves show whitish, sunken, elongated flecks or streaks which may become reddish, purplish, or brown. Severely spotted foliage may die. Stems also frequently show white or light colored streaks similar to those on leaves. The color breaking of flowers, caused by carnation mosaic, is intensified in the presence of the streak virus. The effects are not visible on white varieties but all varieties often have distorted flowers of poor quality.

Obtaining Disease-free Plant Material. -- New seedlings are free from this virus complex. The procedures outlined for mosaic and streak apply to indexing carnations for yellows. Separation of mosaic from the yellows complex may be achieved by the abrasion technique referred to under mosaic.

Yellows-free stocks are quite generally available from propagators who practice continued roguing and insect control.

Maintaining Disease-free Stock. -- Procedures outlined for mosaic and streak are satisfactory.

Effectiveness of the Program Outlined

The procedures outlined for eliminating mosaic have not yet been completely applied on a large commercial scale. The techniques for obtaining and maintaining virus-free carnation plants have, however, been satisfactorily demonstrated under commercial conditions. The conclusion is warranted that the procedures can be expanded to commercial volume when it becomes so desirable economically that growers will exercise the necessary care in isolating and handling the plants. Bioassay indexing for mosaic, using *Dianthus* species, has been the most reliable technique used commercially in the United States. A careful analysis of the cost of such an operation will determine the future status of this procedure.

Streak indexing is successfully done today by commercial propagators. Selective roguing and effective insect control by commercial propagators have reduced this disease to a minimum.

Roguing, reselection, insect control, and discontinuance of susceptible varieties by growers have made yellows a relatively uncommon disease.

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VII. DEVELOPMENT AND PRODUCTION OF PATHOGEN-FREE GLADIOLUS CORMELS

J. G. Bald[1]

Unlike the cuttings of chrysanthemum, carnation, and geranium, gladiolus corms do not lend themselves readily to the culture technique for selecting pathogen-free stock. Progress toward obtaining such stock has, therefore, depended on developing means for freeing propagative material of pathogens. This has been accomplished by hot-water treatment of cormels at an unusually high temperature. The method is given below. It is based on investigations by the Department of Plant Pathology, University of California, Los Angeles. Results have appeared in abstract or summary form (2, 3, 6, 7), have been mimeographed (1), or prepared for publication (3, 8, 9). Tests of the method have been made in other areas (6). Hot-water treatment has successfully eliminated Fusarium oxysporum f. gladioli (Massey) Snyder & Hans. Botrytis gladiolorum Timmerm., Stromatinia gladioli (Drayt.) Whet., Rhizoctonia solani Kuehn, and several species of nematodes and mites from cormel planting stock. Curvularia lunata (Wakk.) Boed. and Septoria gladioli Pass. have not been tested because of the unimportance of these diseases in California. The virus diseases and Pseudomonas marginata (McCulloch) Stapp have not been eliminated by heat treatment, but both are of relatively minor importance, and can be adequately controlled by other means.

Detection of Infected or Infested Propagative Material

The disease may be detected in the parent crop, in the corms, and in cormels that are peeled or cut for examination. On cormels, obvious necrotic lesions or discoloration of husks may indicate the presence of pathogens, but the absence of such lesions does not necessarily indicate their absence. The presence of pathogens in a given lot of material of uncertain health may be determined by culturing methods. The original stock used in a program of the sort outlined should be from vigorous plants free from the more serious virus infections, and as nearly free from pathogenic fungi and bacteria as possible. The objective is to develop pathogen-free stock in the most certain and the cheapest possible manner, not to provide a means of utilizing worthless planting material.

Obtaining Pathogen-free Propagative Material

Only cormels can withstand the high temperatures necessary for the reduction or elimination of Fusarium, the cause of the principal corm-borne disease of gladiolus. Corms are too heat-sensitive to withstand the treatment and too large for the heat to penetrate effectively.

Although cormels should be taken from relatively healthy parent crops, severely infested material has been successfully treated. Cormels that have withstood treatment undamaged have so far been from plants grown in a warm dry climate during summer, and matured and harvested before the onset of cold weather. Cormels grown in cooler climates, or grown and harvested during the cooler season in a warm climate, have not yet survived the required temperature. Tolerance to high temperatures seems to arise from the initiation of full dormancy by warm growing conditions. Cormels maturing under cool conditions become only partially dormant.

During the early stages of the investigations on hot-water treatment, the tetrazolium method of estimating viability of seeds was adapted to give a quantitative estimate of dormancy, resistance to heat, and germinability of gladiolus cormels (7, 8). The tetrazolium method was invaluable throughout the experimental work, but is not yet well adapted to routine estimates of the suitability of cormels for hot-water treatment, or their germinability after treatment.

The most favorable time for treatment of cormels is about 2 to 4 months after digging. Cool storage, like cool growing conditions, reduces and may eliminate resistance of cormels to heat. Conversely, dormancy may sometimes be deepened by warm temperature curing at 95°F (35°C) for 2-4 weeks after digging, or before hot-water treatment.

To accomplish this form of curing, cormels, or parent corms carrying cormels, are placed on trays in a well-ventilated heated room held at 95°F. There must be free circulation of air around and across the trays, and a forced draft to prevent humidity rising too far above the optimum (80 percent saturation). Fresh air may be drawn into the room if the humidity

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rises too high. Cormels carried on the corms are separated at cleaning, which occurs after 6-8 days, and cured at 95°F for 1-3 weeks longer. After curing, cormels are kept at room temperature, not in cool storage, until they are fully dormant and ready for treatment.

If gladiolus cormels are fully dormant when treated, germinability may be improved and the crop of corms increased in size and quality. If the cormels are already germinable, the hot-water treatment may reduce or eliminate their capacity for germination, or depress the yield.

The treatment, apart from any previous natural or artificial conditioning of the cormels, consists of (a) presoak, (b) immersion in hot water at 135°F for 30 minutes, (c) cooling, and (d) drying and storage.

(a) Two types of preconditioning have been used successfully. The original recommenda tion was to soak in water at room temperature 24 hours, drain, and then immerse in the hot water. The second type of preconditioning was designed for lots of gladiolus cormels containing high disease inoculum and mummified small corms or cormels, but it is now given as the standard recommendation. The presoak is extended to 2 days. The cormels are drained, and subsequently soaked 3-4 hours in a 1 in 200 formalin solution before immersion in hot water. A third method, which has not yet been tested on a commercial scale, is to presoak overnight in 5% ethyl alcohol and to add 5% alcohol to the hot-water bath.

(b) Containers for immersion are open mesh sacks, or preferably, metal mesh containers on a wooden or metal frame, with a door on one side. The containers should never be filled to more than 2/3 capacity. The cormels should be quickly surrounded by hot water by submerging or rolling the containers, and should be totally immersed during treatment.

The tank of water should be maintained within 1 degree on either side of 135°F. The water should be thoroughly stirred, mechanically or manually. Thermometers must be standardized against accurately calibrated thermometers at the 135°F point before they are used.

(c) The cormels are removed after 30 minutes immersion, drained quickly, and cooled by plunging them into clean cold water, or spraying with a hose. They are spread thinly on trays to dry in the sun or in a blast of warm air. If they are dried in the original containers they must be periodically turned to expose all the cormels.

All benches, floors, trays, etc., with which the cormels make contact after treatment should be free from contamination. Sterilizing methods that have been successfully used on equipment and storage areas are: spraying with, or immersion in, 1 in 50 commercial (40%) formaldehyde, or 1 in 20 commercial sodium hypochlorite solutions; or fumigation in a room or under a plastic sheet with 4 pounds methyl bromide per 100 cubic feet.

As a post-treatment protectant for the cormels, Spergon dust is recommended. It is moderately effective against surface contamination by disease-producing fungi, and is efficient against the miscellaneous molds that may invade gladiolus cormels if they dry too slowly.

Maintaining the Pathogen-free Status of Propagative Material

To get full benefit from the hot-water treatment, cormels must be planted in clean soil. Clean soil is (a) soil never previously planted to gladioli or related species such as freesia, or (b) soil sterilized by fumigation with methyl bromide, chloropicrin, or steam. Less stringent methods may be applied, but are not recommended since the corms produced in such soil will not be pathogen-free. For example, if neither clean nor treated soil is available, soil managed on an efficient rotation, that has never grown a crop of gladiolus obviously infected with Sclerotinia disease or Fusarium, may be used. In addition, treatment of the soil with calcium cyanamide or Vapam may help to reduce infestation, particularly by Sclerotinia.

A mother-block system to maintain stocks for production of clean cormels is also helpful. The selection methods used in the foundation and maintenance of a mother block may also be used to eliminate serious virus infection and bacterial scab, and to maintain superior clones of a variety. The usual features of the mother-block system are: (a) Plant only from selected hot-water-treated stock. (b) Plant only in uninfested soil, sufficiently isolated from commercial crops to prevent carry-over disease. (c) Inspect and rogue out any diseased or off-type plants. (d) Cultivate, harvest, handle, and store corms and cormels from the mother block apart from commercial crops. (e) Treat cormels from the mother blocks with hot water every year, or as often as is needed to keep the stock pathogen-free. (f) Plant successive mother blocks with corms or cormels only from previous mother blocks. (g) Never introduce new stocks, or return stocks from commercial plantings, into the mother blocks unless they have been hot-water treated and have maintained their vigor and freedom from disease elsewhere for at least 1 year.

Under good growing conditions a mother block planted with cormels will provide a high proportion of corms large enough for flowering stock, a proportion of corms needing one year's increase before they attain flowering size, and enough cormels to plant the next year's mother block. If the cormels obtained are insufficient for this purpose, take the best corms from the mother block, and use them without hot-water treatment to plant a second-year mother block for the production of cormels, which will be hot-water treated and planted the following year. It may be possible to hot-water treat the smallest corms (fives and sixes) and replant for the production of cormels. These produce very high yields of cormels.

From mother blocks, corms for increase and introduction into commercial planting should be planted in soil as clean as possible.

Success so far Attained

From at least one badly diseased commercial lot of cormels of the variety Spotlight, the diseases susceptible to treatment have been almost completely eliminated by a single hot-water treatment. In other badly diseased commercial stocks a single treatment has reduced infection in the crop to a fraction of 1 percent. Even applied after the optimum period for treatment, and without proper care or safe-guards against recontamination, the method has given good commercial control of Fusarium disease, and has practically eliminated the other diseases susceptible to treatment.

The effect on germinability has varied. Germination around 70 to 80 percent has often been obtained after treatment of dormant cormels. Unless treatment is very poorly controlled or is done much too late, 30 to 70 percent germination is to be expected. A range of 50 to 70 percent is considered satisfactory. If lower germination is anticipated it may be compensated by heavy planting of cormels. Some crops showing reduced germination, smaller foliage growth, and reduced total yields of corms as compared with untreated stocks, have still out-yielded the untreated stocks in number of corms available for planting the following season. This reversal in favor of the treated stock has been due to its relative freedom from decay and loss in storage. When the crop from treated cormels equalled or exceeded the untreated checks in percentage germination and vigor, the yields of corms available for planting the following season were far in excess of the checks. There were also relatively enormous increases in cormels from treated stock.

The system has been adopted by several California growers with marked success. Commercially desirable varieties which had been deleted because of disease have been returned to highly profitable cultivation. Quality and quantity of flower and corm production have been improved, resulting in greater profits. The previous uncertainty of production has been largely eliminated. A final indication of the success of the procedure is the fact that it is now being tried and adopted in other States.

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VIII. CULTURE-INDEXING OF BUDWOOD TO PROVIDE VERTICILLIUM-FREE GREENHOUSE ROSES

Stephen Wilhelm and Robert D. Raabe[1]

The Verticillium disease incited by Verticillium albo-atrum Reinke & Berth., a semi-ubiquitous vascular pathogen of many suscepts, is at times particularly damaging to the greenhouse rose crop. Dimock (1, 2) has given poignant reasons for recent outbreaks of the disease in Eastern rose ranges, citing Pacific Coast-grown roses on the Manetti (Verticillium-resistant) rootstock as the major source of infected plants. He further reported the significant fact of bud transmission of the Verticillium disease, i. e., that buds carrying the Verticillium fungus commonly "take" and develop into diseased plants or inoculate the understock even if they do not "take". These are presumed to account for the majority of Verticillium-infected plants in the nursery.

A common practice among Pacific Coast nurserymen has been to depend somewhat upon commercial rose ranges for sources of buds of flowering varieties. The authors have found that certain lots of commercial bud sticks may be infected with Verticillium to the extent of 0.25 to 1 percent, and experiments here have corroborated Dimock's finding (1) that infected buds may develop into infected (i.e., Verticillium-carrying) plants. From the time of budding to digging in California (May 15 to November 15) infected plants, particularly on the Manetti rootstock, show no distinct symptoms of the Verticillium disease, though in experiments by the authors they grew much more slowly than did non-infected plants.

Though it was described as susceptible in Canada by Madden (4), 3 years of tests by the senior author supported by field observatoins have indicated that the Manetti rootstock is resistant here to natural root infection by a commonly prevailing strain of Verticillium. So far as is known, this resistance does not appear to be of the nature of tolerance, in the sense of tolerance of an infected plant to symptom expression. In tests here, involving numerous cultures, Manetti did not become infected naturally through the roots. If the Verticillium pathogen is artificially introduced into Manetti, as through roots cut to expose vascular bundles, or into the wood of shoots, the stock may become infected and may manifest symptoms typical of the disease, but such artificially infected plants usually recover rapidly and new shoots do not contain the pathogen. This unusual Verticillium resistance of Manetti is in sharp contrast to the susceptibility of the Rosa multiflora Thunb. (Thorny, Burr, and Grifferaie forms), R. odorata Sweet, Dr. Huey, and Ragged Robin (Gloire de Rosamanes) rootstocks. Since the recent report of resistance in Manetti (6) a Verticillium strain has been isolated from Manetti rootstocks showing symptoms suggestive of Verticillium wilt. Since original Manetti stocks of this single isolated planting were from several sources, it appears that there now is a Manetti-attacking strain in California.

Detection of Infected or Infested Propagative Material

Since it is a vascular pathogen, and because symptom incitation by it depends upon rather specific conditions of external environment and host maturity, V. albo-atrum can lurk unsuspected in some plants for long periods. Laboratory culture-indexing provides the only way for reliable detection. Natural straw-agar media, particularly barley and pea straws, sterilized by propylene oxide (3, 7) are particularly suitable for isolation of the Verticillium fungus. Microsclerotia of V. albo-atrum, which render the identification of the fungus easy, form abundantly in these straws (8) and contaminants produce only restricted growth. Five bud sticks containing an aggregate of at least 15 buds may be cultured in a single Petri dish, provided complete cross sections of the vascular cylinders are cut from the basal ends of the bud sticks. Sharp stout blades such as Bard-Parker Series 20 are ideal for cutting this rather hard material.

Obtaining Pathogen-free Propagative Material

A large percentage of the greenhouse roses are grown on the Manetti rootstocks. Established mother blocks of culture-indexed Verticillium-free greenhouse rose varieties for use as bud sources would go far toward the elimination of the Verticillium disease from greenhouse

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roses grown on these rootstocks.

Susceptible rootstocks, such as R. odorata, R. multiflora, Shafter, Dr. Huey, and Ragged Robin, because they may carry the Verticillium fungus, would also have to be culture-indexed before being "struck" in the ground. Because Manetti may succumb to some Verticillium strains, it should also be cultured. Susceptible understocks would have to be maintained on land known to be free of the Verticillium fungus, as on land without a previous history of susceptible plants, particularly tomato, potato, cotton, or the nightshade weed, Solanum sarachoides Sendt., or on land fumigated to eradicate the fungus. Fumigation is at present costly and the results have not always been dependable. Once Verticillium-free root-stock blocks have been established, they could serve as a source of clean propagative material or could be budded over to greenhouse flowering varieties and serve as propagative material for these. Budwood of greenhouse flowering varieties should be culture-indexed and used only if found free of the pathogen.

The feasibility of using hot-water therapy to rid budwood of Verticillium infection was rejected in studies by Nelson and Wilhelm (5).

Maintaining the Pathogen-free Status of Propagative Material

Because of the resistance of Manetti to most of the common strains of Verticillium, Manetti would be the best stock on which to maintain and to increase culture-indexed flowering varieties. Precautions should be taken to prevent rooting of the flowering variety from above the bud union. Outbreaks of Verticillium wilt in greenhouse roses on the Manetti rootstock in the San Francisco Bay area definitely have been attributed to such rooting. An additional precaution, though of questionable necessity, would be to sterilize pruning and budding tools before using them in the mother blocks. The possibility of spread of Verticillium by pruning, which has been reported as an important factor in the Verticillium disease of raspberry (9), is under study now.

On the basis of present knowledge it would be advisable to maintain mother block bud sources of greenhouse flowering varieties on the Manetti root-stock. Should it be desirable, because of compatibility or other relationships, to maintain mother blocks on susceptible rootstocks, any introduction of the Verticillium fungus could be detected by symptoms of the disease produced in the affected plants. Careful observation and roguing of such plants should be practiced, especially during the period of best symptom expression. Symptoms in flowering varieties are more severe on susceptible rootstocks, and in central California nurseries they usually occur in severe form during the summer months. Affected plants may recover somewhat in the fall.

Success Attained in Practice

One large rose nursery, by (a) moving to land without a previous history of Verticillium-susceptible crops, (b) establishment on this land of a culture-indexed mother block of one greenhouse variety on Manetti rootstock, and (c) obtaining propagative material both of rootstocks and buds of flowering varieties from an area determined by survey and numerous cultures to be free from the disease, has attained remarkable success in producing healthy, Verticillium-free plants.

Other nurseries, established on Verticillium-free land as far as is known, undoubtedly have greatly lessened the possibility of producing Verticillium-carrying plants by avoiding buds from commercial rose ranges.

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IX. DEVELOPMENT AND PRODUCTION OF PATHOGEN-FREE PROPAGATIVE MATERIAL OF FOLIAGE AND SUCCULENT PLANTS

Kenneth F. Baker and Philip A. Chandler[1]

In recent years interest in foliage plants and succulents has greatly increased, and this has focused attention on the frequent large disease losses in the commercial production of these crops. Growers have tended to accept such losses as part of the risks of the business, and have learned to reduce disease somewhat through cultural modifications. Usually, however, these changed practices produce undesirable side effects. Thus, minimal irrigation may reduce the severity of water-mold root rots in foliage plants and succulents, but it also reduces growth rate and the size attained, and requires careful hand watering. The over-all effect is to increase production time and cost over that of a disease-free crop. Because these crops are grown in containers, it is entirely practicable to use treated soil and pathogen-free stock, and to produce disease-free plants for sale. Besides the saving to the grower, this increases the satisfactory life of the plant after sale, benefitting the customer and expanding the market for such materials.

Following the commercial demonstration of the efficacy of the program of eliminating rather than continuing to fight disease in these crops, there has been increasing interest in the procurement of pathogen-free stock (2). The results with this approach for several of these crops are presented here, illustrating several methods of obtaining such stock.

1. *Dieffenbachia picta* Schott

Much of the cane used for propagation of this plant is grown under field conditions in Puerto Rico and Florida. When received by the grower, the canes often have lesions of bacterial soft rot, probably caused by *Erwinia carotovora* (Jones) Holland, and Phytophthora stem rot caused by *P. palmivora* Butl. (5). A high percentage of the cut stem pieces usually decay in the propagating bench, and plants produced may later succumb to stem rot (5) or develop bacterial leaf spot caused by *Xanthomonas dieffenbachiae* (McCull. & Pirone) Dowson (4).

Obtaining Pathogen-free Propagative Material. -- If cane is obtained from field plantings in humid areas it has been found best to treat it routinely in hot water before planting. Alternatives are for the grower to produce his own cane from healthy plants which may sometimes be found, or to buy cane or started plants from a specialist propagator who maintains pathogen-stock.

The growth-status of the cane is important in determining the extent of injury from the treatment. If mature hardened canes are used they tolerate the necessary 125°F, if they are soft (as is much of the field-grown material) only 120°F may safely be used. Cane may be hardened by growing with minimal quantities of water and nitrogen for several months prior to cutting. Young leafy tips should be removed, as they will not survive treatment. The canes are cut into pieces about 2 feet long and treated in hot water at 125°F for 30 minutes. They are cooled at once by either dipping in clean cold water for several minutes, or by flooding with tap water. The canes are held in benches of steamed sphagnum moss until roots or buds start, and then cut into pieces, each with a single bud. These are planted immediately in a perlite and peat mixture, and transplanted to treated soil when the top is well started.

Stock obtained in this way may be grown in a glasshouse without any overhead watering, and tip cuttings taken when the plants are 12 inches or more tall. Such cuttings will be pathogen-free, even when the initial stock may have been treated only at 120°F. In some cases it may even be possible to obtain the initial healthy stock from this measure alone.

Maintaining the Pathogen-free Status of Propagative Material. -- The healthy cuttings obtained must be so handled that recontamination is avoided. The cane or cuttings must not be placed in untreated containers or on untreated soil. Only steamed sphagnum and treated perlite-peat or soil should be used in treated pots or benches. There is evidence that soft-rot bacteria may be spread through the propagating bed by larvae and adult fungus flies. Spraying the soil surface with Dieldrin or Malathion (wettable powders, 1 ounce per 7 1/2 gallons of water) has given promise

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in controlling these insects. If the pathogen-free stock obtained is to be used for subsequent propagation it must be isolated from the commercial production area and carefully handled as a nucleus block. This will further protect the stock from contamination by fungus flies.

Success Attained in Practice. -- One commercial grower, who has been using these methods for 5 years, has largely eliminated disease losses in production. It has also been found by him and by us that the percentage of buds which break dormancy is increased by the hot-water treatment.

2. *Fittonia verschaffeltii* Coem. var. *argyroneura* Nichols and *Pellionia pulchra* N. E. Br.

These plants sustain heavy losses from stem rot and leaf decay caused by *Rhizoctonia solani* Kuehn and by water fungi.

Obtaining Pathogen-free Propagative Material. -- If a few healthy plants are available, or can be obtained from a specialist propagator, a grower may build up his own pathogen-free stock. Usually, however, it is necessary for the grower to develop his own nucleus stock. Plants may be grown up on a wire frame; by removal of lateral shoots the stems may reach 12 inches from the soil. If overhead watering is avoided, the tips of such shoots may provide a source of pathogen-free stock. It has been found commercially possible to obtain clean stock by planting such tip cuttings in treated soil, and repeating the procedure several times. They may, however, be more easily and rapidly obtained by hot-water treatment.

Hardened plants are best used for the treatment in hot water at 124°F for 30 minutes. Unhardened plants may survive only 120°F. The plants may be hardened as explained for Dieffenbachia. Clean the plant of dead leaves and soil before treatment. Cool rapidly in clean cold water following treatment. Make cuttings and divisions, removing any damaged leaves, and plant at once in a mixture of perlite and peat, where roots may form in less than a week. The leaves are very sensitive to the treatment and may be killed. Such dead leaves should be promptly removed to reduce to reduce invasion by *Botrytis cinerea* Fr. ex Pers. and bacterial soft rot. The stems are quite heat tolerant, and new shoots will develop from them.

Maintaining the Pathogen-free Status of Propagative Material. -- The healthy status of the nucleus stock may be maintained by growing in treated soil and containers in an isolated glasshouse area. It would be advisable to grow the plants on wire frames up off of the soil and to take tip cuttings for planting in the increase block. Wetting the foliage should not be permitted in watering, and careful sanitation should be routinely followed.

Success Attained in Practice. -- One commercial grower has utilized the program with outstanding success. The Fittonia plants are hot-water treated and planted in individual pots of steamed soil. When these have grown to a height of 6 inches under conditions of general sanitation without ever wetting the foliage, tip cuttings are taken. These are rooted in steamed sand and planted in pots. Completely pathogen-free nucleus blocks were established by the time this procedure had been followed through 3 generations. At first the cuttings were rooted in sand and planted in small pots, taking 8 to 10 weeks to produce saleable size. Now the cuttings are planted directly into small pots of a University of California type soil mix (50% peat, 50% fine sand). Automatic misting is practiced, without loss from Rhizoctonia or water molds. Production now requires only 5 weeks. Over a quarter million young plants are raised annually by this grower in scheduled production by this method.

3. *Syngonium auritum* (L.) Schott

A black cane rot, caused by a specialized form of *Ceratocystis fimbriata* Ell. & Halst., is sometimes destructive on this crop in commercial nurseries (3).

Obtaining Pathogen-free Propagative Material. -- Since there is still a good deal of stock available that is free from this fungus, there is little difficulty in obtaining healthy stock. A heat treatment is a more certain and faster method. Plants should be hardened as described under Dieffenbachia to increase the heat tolerance. Whole plants are bare-rooted and treated in hot water at 120°F for 30 minutes. They are then promptly cooled and planted in soil. There is some leaf injury, but plants quickly recover. If stems are badly cankered it would be well to cut them above the injured area; new roots will form quickly and the plant will grow faster without the stricture.

Maintaining the Pathogen-free Status of Propagative Material. -- See Fittonia and Pellionia.

Success Attained in Practice. -- There has been no commercial attempt as yet to place this program in practice, but the ease of its accomplishment in experimental glasshouses gives strong assurance of its practicability should it later be needed.

4. *Syngonium podophyllum* Schott var. Emerald Gem

This plant frequently is injured by root rot caused by water fungi in commercial nurseries.

Obtaining Pathogen-free Propagative Material. -- The use of tip cuttings from plants grown up 12 inches or more above the soil under conditions where the foliage has not been wetted will often give healthy stock. A heat treatment is coming into use because of its effectiveness both against pathogens and in breaking dormancy of cane buds. Cane is treated in pieces about 2 feet long and is relatively tolerant of the hot-water treatment at 120°F for 30 minutes. Material hardened as for Dieffenbachia will survive 125°F for 30 minutes. Because of injury this temperature should be used only for treatment of nucleus stock. The canes are cooled rapidly in water, and then held in a humidity cabinet at 70°F for 2-3 weeks before being cut into pieces and planted in perlite and peat.

Maintaining the Pathogen-free Status of Propagative Material. -- See Fittonia and Pellionia.

Success Attained in Practice. - Used in one commercial nursery with marked success. The heat treatment probably will be largely used for its increase in the number of buds breaking dormancy, the riddance of disease organisms being a gratuitous accompaniment.

5. *Aloe variegata* L. and *Haworthia attenuata* Haw.

Young seedlings of these plants frequently are discarded because the roots have been rotted by *Pythium ultimum* Trow. Since 2 to 3 years are required to produce such plants, the economic loss may be considerable. Usually the decay does not progress from the roots into the stem, and the plants therefore can be salvaged by a hot-water treatment.

The disease can easily be prevented in seedlings by (a) using seed produced on stalks kept up off of the ground in semi-arid localities, (b) planting only in treated soil and containers, and (c) practicing reasonable sanitation. The hot-water treatment is to be viewed purely as a salvage operation of either seedlings improperly grown or of large, old, field-grown seed plants whose roots have been decayed. The method has shown such merit as to warrant its description here.

The seedlings or adult plants are cleaned of dead basal leaves, soil, and dead roots before immersion in hot water at 115°F. The period of treatment varies from 20 minutes for small plants to 40 minutes for large ones. The plants are cooled promptly in cool clean water, and planted at once in treated soil and containers. With care to avoid recontamination the treatment has given complete elimination of the disease. Plant injury is so slight as to be inconsequential (1).

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X. DEVELOPMENT OF ROSE PROPAGATIVE MATERIAL FREE FROM BLACK SPOT

Eldon W. Lyle[1]

Black spot, caused by the fungus Diplocarpon rosae Wolf, is the most widespread and destructive disease of roses. It occurs in nearly every State of this country, being naturally restricted only in semi-arid areas, and even there the disease may become prevalent if overhead watering is practiced.

Damage from black spot is mainly from its defoliation effect, which weakens the bushes, reduces flower production, and increases susceptibility to cane die-back and winter-killing. Severe infection decreases cane size of the bushes (4), diminishes number and size of blooms, lightens flower color, and decreases fragrance, besides impairing the chances of transplanting survival. Also objectionable are the unsightly blotches of the fungus infections.

The disease is serious in commercial fields as well as in home gardens. Sanitary measures and treatments to delay or prevent primary infections are of great importance in the control of black spot.

Detection of Infected or Infested Propagative Material

While the leaf symptoms of black spot are important in detection of the disease, it is the cane lesions which probably provide the spores most effective in spreading the disease during rose propagation by budding. Inspection of rose fields or gardens from which scions are to be taken offers the best means for detecting infected propagative material. The usual inconspicuous cane lesions of black spot ordinarily are accompanied sometime during the year by numerous and noticeable leaf infections. Absence of leaf infections at one time of year would not necessarily mean lack of cane lesions. However, periodic examinations of a rose planting through its complete season of growth without the finding of foliage symptoms would be acceptable proof of the freedom from black spot of the branches to be used as scions.

Obtaining Pathogen-free Propagative Material

Control of black spot and complete prevention of its spread has been accomplished under greenhouse conditions by keeping water off the foliage during irrigation, and by elimination of syringing as a means of insect control. Infected plants have been maintained in close proximity to healthy ones without spread of the fungus, as long as spattering of water on the foliage did not occur. Studies on the epiphytology of the black spot disease (1) showed that the conidia are disseminated mainly by splashing water. The conidia remain stuck together above the acervuli until contacted by particulate water. Once loosened, the spores are rapidly spread by spattering water or by windblown rain. After being wetted, the spores are capable of germination, but require continued contact with water or relative humidity of 92 percent or more for at least 6 hours to germinate. Both the upper and lower surfaces of the leaves may be infected.

Besides careful production in greenhouses another source of scions free from the pathogen would be regions that are so dry and deficient in rainfall that extensive ditch irrigation is necessary for bush production (e.g., in the commercial rose fields of California and Arizona). Black spot has not been observed by the writer under such conditions except as noted in some home gardens where overhead sprinkling is practiced.

Securing black spot-free scions by breeding for resistance to the disease is another possibility, but not much progress has been made yet in present-day varieties. However, certain strains of Rosa multiflora Thunb. have been found immune or nearly so, and a few other species and varieties have shown resistance, if not immunity, and could be used in hybridization.

Maintaining the Pathogen-free Status of Propagative Material

Once obtained, it is only necessary to keep the foliage dry and or to use protective fungicides to prevent primary infections of black spot. Periodic inspections of the foliage would determine this need.

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Success Attained in Practice

Unfortunately, the practice of starting with pathogen-free scions and using the immune Rosa multiflora understock has not entirely prevented the subsequent development of black spot under Texas field conditions. However, the appearance of the disease was delayed, and showed the value of using pathogen-free scions (2, 3). In one such trial using scions developed in a greenhouse and known to be free from black spot, the disease became evident in the field late in the first year after budding and forcing; this trial was isolated from other roses by about 550 feet. In another trial, it was early in the second year before primary infections occurred. The isolation was not sufficiently great to exclude introduction of the pathogen by some natural means.

For the commercial propagation of roses, many nurserymen now appreciate and are capitalizing on the advantage of securing budwood from locations that do not have black spot, or from fields that have been effectively treated with fungicides to control it. Thus, there is a definite carryover of benefit into the second year following the control of black spot, delaying and decreasing its incidence. Furthermore, the percentage survival of scions has been as much as 50 percent better when the budwood came from bushes free from black spot than when budwood was used from fields where the disease was prevalent.

This development of clean budwood does not represent complete exclusion of a disease, but it does provide an important control measure for the rose growers in areas where black spot might otherwise be a problem. If it becomes commercially desirable to provide blackspot-free plants, these can presently be produced under field conditions in semi-arid areas, provided all overhead sprinkling is avoided.

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XI. DEVELOPMENT AND PRODUCTION OF PATHOGEN-FREE GERANIUM PROPAGATIVE MATERIAL

Donald E. Munnecke[1]

Since geraniums (Pelargonium hortorum Bailey) are almost exclusively propagated vegetatively rather than from seeds, the production of pathogen-free cuttings is of the greatest importance. Because cuttings generally are taken from well up on the plant, only a few of the pathogens of the various diseases, including bacterial stem rot (Xanthomonas pelargonii (Brown) Starr & Burk.), virus diseases, Verticillium wilt (V. albo-atrum Reinke & Berth.), and cutting rots (Pythium sp. and Rhizoctonia solani Kuehn), are commonly transmitted by them. Of these, bacterial stem rot and virus diseases are the most important.

Methods of Detecting Infected or Infested Propagative Material

The diseases of geraniums most difficult to detect are those which either invade the vascular system (bacterial stem rot and Verticillium wilt), or are systemic (virus diseases). These diseases produce characteristic symptoms, but they may be masked and thus be difficult to diagnose accurately by visual means. Furthermore, cuttings of some varieties may harbor the causal pathogens without any external symptoms.

Symptoms are helpful in initial elimination of plants suspected of harboring disease. However, the only positive way of detecting pathogens is to culture a portion of each cutting on laboratory media. With bacterial stem rot the culturing method may be confirmed by macerating in water a portion of the cutting and inoculating a young susceptible plant (Radio Red variety) by puncturing the stem with a needle and placing the decoction in the wounds. In 2 to 4 weeks the lower leaves wilt and die, and gradually the stem rots and blackens if the decoction contains the bacterial pathogen. This latter method is most useful in detecting the bacteria in rotted tissue which cannot be cultured because of the presence of other organisms. In several cases in which we have been unable to isolate bacteria by culturing, the inoculation technic was positive. This applies especially to rotted cuttings.

Methods for Obtaining Pathogen-free Stock

Pathogen-free geraniums may be obtained commercially by the following procedures:

1. Select Apparently Disease-free Plants for Initial Cutting Source. --

a. Fungus and bacterial diseases. Use plants for source of cuttings which have been observed for at least 6 months with no symptoms of these diseases.

b. Virus diseases. The detection of virus diseases of geraniums is still based upon the visual symptoms produced. This is a serious obstacle in producing clean stock, since the virus symptoms are frequently masked in summer, and occasionally in winter as well. Another difficulty has been the uncertainty of the role of insects in transmission of the common virus diseases. Furthermore, graft transmission studies have shown that symptoms may not appear for 6 months on the stock plant on which a virus-infected scion was grafted.

Virus diseases could be avoided if plants produced directly from seed were used as stock plants. Although geranium seed is offered for sale, seed of commercial varieties, true to type, is not available. As virus diseases are becoming extensive, a breeding program may have to be undertaken to produce varieties for commercial production which come true from seed. The alternative, less certain way, is to select parent plants that have been closely observed for several years, especially in the cool seasons, and that have shown no symptoms of virus. By promptly roguing any plants with the slightest symptom of virus infection (leaf roll, mosaic, small leaves, dwarfed plants, distorted flowers) virus-free plants may be obtained. In this way under glasshouse conditions we have obtained plants presumed to be free of virus diseases.

2. Culture the Cuttings. -- The laboratory cultured-cutting technic (agar slant, as described in Papers 2 and 5 of this series) is used to be certain that the supposedly disease-free cuttings selected actually are free of pathogens. This method will permit selection of stock free from bacterial and fungus pathogens, but is inapplicable for viruses. Cuttings presumed to be free from virus should be tested for the other diseases even though the parent plants were without

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symptoms for several years.

3. Establish a Nucleus Block. -- Each cultured cutting should be rooted separately in sterilized sand and then planted in individual pots or in a raised bed with less than 10 plants per block in soil that has been steamed or treated with methyl bromide or chloropicrin. It is desirable to grow them in a glass or plastic house to afford protection from insects and inclement weather. Since the nucleus block is the most valuable part of the whole operation, the plants must be very carefully grown, preferably by the proprietor or the most careful grower in the organization. Great care must be taken to prevent these plants from becoming infected. Botrytis rot may be avoided by removing the flowers as they are formed, cleaning off dead leaves and debris, and pruning the plants to form an "open" type of growth so that air circulates freely in the center and around the base of the plants. A special set of tools, water hoses, etc., should be reserved for use only in this nucleus block. Implements should be disinfested before use by washing off the dirt and immersing for 1 minute in a 5% formaldehyde solution; they should then be rinsed with water. Hands should be washed with soap and water before handling the plants. Insect control should be maintained at all times by frequent spraying or dusting with malathion, DDD or DDT, or a combination of the 2 materials. When taking cuttings use 2 knives and disinfest by dipping in 1:1000 mercuric chloride solution. Use one knife to take the cuttings from a plant while the other knife is in the disinfectant and then exchange knives for taking cuttings from the next plant. Cuttings may be broken off as is done with carnations and chrysanthemums; however, this often results in excessive wounding of the stock plant and predisposes the plant to attack by Botrytis. Each plant should be numbered and the cuttings taken from them for the increase block (see below) should be numbered so that they may readily be identified with the parent plant. In the event a nucleus block plant or one of its progeny develops symptoms of stem rot, virus, Verticillium wilt, or other disesase, it and all of its progeny should be immediately destroyed. Here the advantage of growing the nucleus block plants in individual pots becomes obvious. If a plant becomes infected the spread of disease is easily checked by prompt removal of the entire plant and soil if planted in an individual pot. If planted in a bed all of the plants in that bed must be removed and the soil and bench resterilized before replanting. Thus, the advantage of better disease control obtained by the individual pot outweighs the cultural advantages obtained by the raised bed method. No plant from the increase block should ever be planted in or near the nucleus block, without prior long observation of its health status.

4. Establish an Increase Block. -- Root cuttings from the nucleus block plants in steamed or chemically-treated sand, and plant in ground beds, greenhouse beds, or benches likewise treated for disease control. Number each as outlined above. Exercise every reasonable care in handling. However, since this is a much larger planting it cannot be protected so rigidly as the nucleus block. Follow the same strict sanitary precautions and procedures in so far as possible, and allow only the best workers to handle the plants in this block.

5. Establish Production Blocks. -- This varies with the size of the operation and the number of cuttings desired. Plant rooted cuttings produced from the increase block in ground beds or in a field which has been treated with chloropicrin or methyl bromide. Cuttings taken from this field are never retained as propagative stock, but are sold. Again, sanitation and culture operations should be as nearly like those of the nucleus block as possible. Since mercuric chloride is poisonous and may be misused by field laborers, use 70% methyl alcohol as a knife disinfectant.

In the system outlined above, the movement of cuttings is from the nucleus to the increase block, and from that to the production block. Also, there is a size progression from a small, compact, one-man-operated plot to large production blocks.

Methods for Maintaining the Pathogen-free Status of the Stock

The stock may be maintained pathogen-free by continued application of knowledge of the nature of the diseases and how they are spread, and practicing of methods of preventing recontamination. Among such measures are:

Soil Treatment. -- All cuttings should be rooted in steamed or chemically treated media. Soil for the nucleus block and increase blocks must also be treated. The production block should be planted on steamed or chemically treated soil.

Disinfestation. -- Knives may be disinfested by dipping in mercuric chloride or methyl alcohol for about 1 minute before reusing. Five percent formaldehyde may be used in a similar manner to disinfest tools.

Sanitation -- Remove debris, dead plants, and plant trimmings from growing area. The tools used on the nucleus block should only be used there. Avoid contaminating beds by scuffing dirt on them, walking on them, handling the soil unnecessarily, etc.

Isolation. -- Nucleus blocks must be isolated from other geraniums by growing in a greenhouse or plastic house in a different location from the main growing area.

Culture Methods. -- A 1 year crop rotation or soil sterilization with steam or chemicals is necessary to avoid the present worst disease, bacterial stem rot. Careful watering of plants to avoid wetting the foliage is necessary to prevent the spread of disease. Ditch irrigation should be used for field operations, and hand watering using a breaker nozzle on the hose to prevent splashing should be used for the nucleus block and increase blocks. Insects should be kept down by frequent spraying or dusting with insecticides.

Success Attained in Commercial Practice

A program similar to the one outlined here has been under way in California for about 18 months in several commercial establishments. It is too early to evaluate the success it has had but the growers have been enthusiastic about their early results. It is estimated that disease-free plants in the nucleus blocks and increase blocks have produced from 2 to 3 times the number of cuttings as compared to plants grown in the usual way. Another point which has not yet been commercially proved is the fact that disease-free plants may yield so many more cuttings per plant that the extensive acreages now planted may be cut to a relatively small, highly intensified type of agriculture with much more efficient use of land, labor, and materials.

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PLANT DISEASE EPIDEMICS
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PHYSIOLOGIC RACES OF PUCCINIA GRAMINIS IN THE UNITED STATES IN 1955

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops
Research Branch

Plant Industry Station
Beltsville, Maryland

PHYSIOLOGIC RACES OF PUCCINIA GRAMINIS IN THE UNITED STATES IN 1955[1, 2]

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Summary

Race 15B, which is still the most prevalent race of wheat stem rust in the United States, decreased from 63 percent of the isolates in 1953 to 47 percent in 1955. The 17-29 group which will attack such varieties as Selkirk and Bowie increased from 4 percent in 1953 to 20 percent in 1955. Race 56, third in prevalence, decreased slightly since 1953 to 18 percent in 1955. Race 48A, found for the first time in Mexico in 1953, increased in the United States from 4 percent in 1954 to 5 percent in 1955.

From 31 rusted barberry collections, 25 races and biotypes were isolated, 18 of which were isolated only from or near barberry. The ratio is 1 race to every 1.2 collections.

Race 7, which has been the most prevalent race of oat stem rust since 1950, increased from 58 percent of the isolates in 1954 to 68 percent in 1955. Races 2 and 8 each comprised 12 percent. Race 7A decreased in prevalence from 9 percent in 1954 to 5 percent in 1955. Race 6 was identified in a uredial collection from Columbia, Missouri. It is the first time this race has been found independently of barberry in the Upper Mississippi Valley Region. A variant of race 5, designated as 5A, was isolated from a collection of Saia oats adjacent to barberries at Blacksburg, Virginia. This is the first record of a race in the United States that can attack Saia.

Puccinia graminis tritici

In the United States, 28 races and biotypes or subraces of Puccinia graminis tritici were identified among 755 isolates from 574 uredial collections of wheat, barley, and grasses (Table 1). Race 15B comprised 47 percent of the isolates; the 17-29 group 20 percent; race 56, 18 percent; 48A, 5 percent; and races 11, 38, and 59 comprised 2 percent each. Other races were 1, 14, 15, 21, 23, 24, 29, 33, 35, 36, 38-48 group, 44, 81, 118, 122, 125, 139, and 186.

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[1]Cooperative investigations of the United States Department of Agriculture and the Minnesota Agricultural Experiment Station. Published with the approval of the Director, Minnesota Agricultural Experiment Station.

[2]For summaries for the years 1939 through 1942, see 522 and 522A to C in the Bureau of Entomology and Plant Quarantine E-series; for 1943, 1944, 1945-49, and subsequent reports through 1953, see unnumbered publications in the Physiologic Races series; for 1954, see ARS-81-3.

[3]Pathologists, Plant Pest Control Branch, Agricultural Research Service, United States Department of Agriculture.

[4]Agents, Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture.

[5]E. C. Stakman continued leadership in the search for supplemental differential varieties and assisted in race identification at various times. Acknowledgment for collections is made to Donald G. Fletcher, of the Rust Prevention Association, and to members of the two Branches and of State Experiment Stations.

Although 15B is still the most prevalent race in the United States, it has decreased from the high of 63 percent in 1953 to 47 percent in 1955. The race 17-29 group increased from 4 percent in 1953 to 12 percent in 1954 and 20 percent in 1955 (Figure 1). Race 56, third in prevalence, decreased from 19 percent in 1953 to 12 percent in 1954 and increased to 18 percent in 1955. Race 48A, which was found for the first time in Mexico in 1953, increased in the United States from 4 percent in 1954 to 5 percent in 1955. The race 49-139 group comprised 1 percent of the isolates in 1953, but only 2 and 1 isolates were found in 1954 and 1955, respectively.

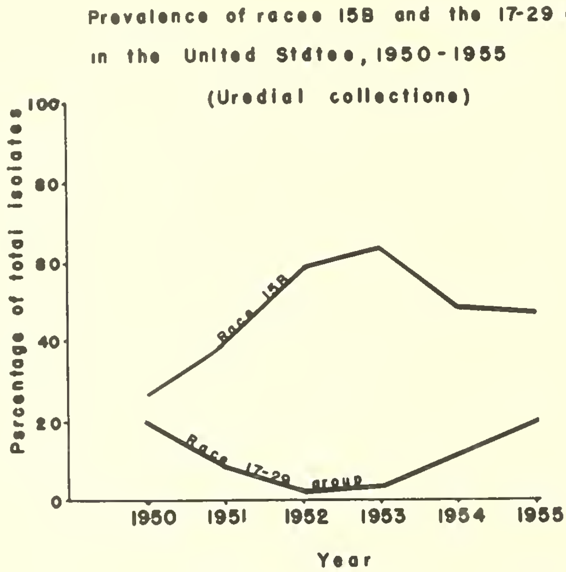

FIGURE 1.

Race 15B was widely distributed except west of the Rocky Mountains, where no collections of this race were identified in 1955. It has not yet been found in California.

Race 15, which is more virulent on some varieties than some biotypes of 15B, was isolated once each from North Dakota and Wisconsin. The isolate from North Dakota came from a collection of durum wheat, R. L. 3207, at Fargo.

The 17-29 group (mostly 29), which will attack some of the newer varieties such as Selkirk and Bowie, was very prevalent in Mexico and widely distributed in 21 States of the United States. It was common in the southeastern states from Florida northward to Pennsylvania and North Dakota, and westward to Idaho. It was fairly prevalent in Texas, Missouri, Minnesota, and North Dakota but was found only 1 or 2 times each in Colorado, Kansas, South Dakota, and New York and not at all in Oklahoma and Nebraska.

Race 38, although widely distributed, comprised only 2 percent of the isolates compared to 12 percent in 1954. It was most prevalent in Virginia but was found only occasionally in Kentucky, Michigan, North Carolina, Ohio, Pennsylvania, South Dakota, and Texas. The race 38-48 group decreased from 5 percent in 1954 to less than 1 percent in 1955. It was isolated twice from Idaho.

Race 48A, which can cause severe infection on Bowie and Travis wheats, was widely but irregularly distributed from the southeastern states northwestward to Ohio, Illinois, and Indiana. It was prevalent in Texas and was found occasionally in North Dakota, South Dakota, and Idaho.

Race 56, with 18 percent of the isolates, was widely distributed in 25 of 30 states. It was not found in California, Mississippi, New York, Washington, and West Virginia.

Race 11 was widely distributed in 9 states but comprised only 2 percent of the isolates. Some of the isolates of this race are known to be virulent on certain wheats. It appears to be endemic in California and has been found in the Sacramento Valley each year since 1952. This race was isolated from a collection of Kindred barley from Davis in 1955. In subsequent studies in the greenhouse at St. Paul, the isolate from Kindred produced an intermediate rust reaction (infection type X) which ranged from 0; to 4^{cn} [6] on seedling plants of Kindred. This is the highest infection type observed so far on Kindred seedlings with any race to which it has been tested. Race 11 was also found in Idaho, and east of the Rocky Mountains it occurred in Illinois, North Dakota, Ohio, Texas, North Carolina, Virginia, and Florida. It was also isolated from barberry in Iowa, Illinois, and Virginia.

Race 139, which was prevalent in 1952-53, is still persisting by means of the barberry. Two isolates were identified in 1955 from aecial material and 1 on wheat near barberry in Virginia.

Special attempt was made to identify a considerable number of collections from barley and wild grasses, particularly in those areas where it is known that the wheat varieties are resistant to certain races. From 48 collections made in 1955 of barley and wild grasses, 62 isolates were identified, representing 10 races. Race 15B comprised 60 percent of the isolates; race 56, 18 percent; race 17-29 group, 10 percent; and there was 1 isolate each of races 11, 15, 36, 44, 48A, and 59. However, the relative percentages of races obtained in this way were not essentially different from those in the United States as a whole.

A number of rare or uncommon races were isolated from uredial collections made in barberry areas. Races 14, 23, 118, and 125 were identified from Virginia and races 81 and 186 from New York, all probably originating on barberry.

From 31 aecial collections from barberry in 7 states, 51 isolates comprised 25 races and biotypes, 18 of which were isolated only from or near barberry. The ratio of races to collections is 1:1.2 (Table 2). Four of the 25 races attack Vernal emmer.

During 1954 and 1955, special sets of varieties additional to the differential varieties were inoculated with selected samples of certain races that are difficult to identify on the standard differentials under all environmental conditions. This was done in an attempt to obtain more precise information on some of the group-race complexes and to obtain varieties useful as supplemental differentials.

Following is the list of supplemental varieties used in 1955:

1. Triticum timopheevi

2. Common wheats
   - Bowie (Tex. 3708-22)
   - Frontana x (K58-Nwth) II-50-17 (C.I. 13154)
   - Kenya 117A (C.I. 12568)
   - Kenya 117A (Australia 1347)
   - Kenya Farmer (C.I. 12880)
   - Khapstein (Australia 1451)
   - Lee x Mida Sib (NS 3880-227) (C.I. 13043)
   - Magnif Disro (Argentina, S.A.)
   - Magnif G (Argentina, S.A.)
   - Magnif MG (Argentina, S.A.)
   - N.D. 1 (Conley)
   - N.D. 3
   - Selkirk (C.I. 13100)

3. Durum wheats
   - Beladi 116 (Egypt)
   - C.I. 3255 (Spain)
   - Ld 364 (Yuma)
   - Ld 368 (C.I. 13164)
   - Ld 369 (Ramsey)
   - Ld 370 (Towner)
   - Ld 372 (Langdon)
   - R.L. 3206 (C.I. 13141)

[6] 0; denotes hypersensitive necrotic flecks; cn indicates chlorosis and necrosis surrounding uredia.

R. L. 3207 (C.I. 13142)
Tremez Molle (Portugal) P.I. 56258-1

The following varieties differentiated several subraces within indicated groups: the 11-32 group, N.D. 3, Ramsey (Ld 369), and R.L. 3206; 15B, Kenya 117A (C.I. 12568), Magnif MG, R.L. 3206, and Yuma (Ld 364); the 17-29 groups, C.I. 3255, Magnif MG, Ramsey (Ld 369), R.L. 3206, and Tremez Molle; 48A, Magnif G and Magnif MG.

Puccinia graminis avenae

A total of 508 isolates of oat stem rust, comprising 7 races, were identified from 431 uredial collections (Table 3). Of these, the following were most prevalent: races 7, 8, 2, and 7A. Race 7 comprised 68 percent of the isolates; race 8, 12 percent; race 2, 12 percent; and race 7A, about 5 percent. The other races were found only occasionally. Twelve isolates of race 5 were identified from Missouri, Texas, and Virginia. The potentially dangerous race 6, hitherto associated closely with barberry in the northeastern states, was isolated once each from Missouri and Pennsylvania and twice from New York. Race 13, closely related to 6, was identified twice from Maine.

Race 2 was isolated twice from aecial collections in Virginia.

Race 7 increased in prevalence from 58 percent in 1954 to 68 percent in 1955. It was isolated from 25 states but not from California, Idaho, Tennessee, Florida, Maine, or New Hampshire.

Race 8 decreased from 17 percent in 1954 to 12 percent in 1955.

Race 7A decreased in prevalence from 9 percent in 1954 to 5 percent in 1955. It was found in 12 states from Oklahoma to Minnesota and westward to Montana. A few isolates were also identified from Georgia, Indiana, and Pennsylvania. This race is differentiated from race 7 on Rodney (R.L. 2123). At low or moderate temperature, Rodney is a good differential for 7 and 7A, but at temperatures above 80°F. the infection type produced by race 7 approaches that produced by 7A. Because of the high temperatures that prevail in the greenhouse during the summer months, the differentiation between 7 and 7A on Rodney is virtually impossible.

The identification of race 6 in an oat collection from Columbia, Missouri, is noteworthy, as this is the first time this race has been found independently of barberry in the Upper Mississippi Valley region. Race 6 was also identified at St. Paul from 2 varieties grown in the Uniform Rust Nursery at Winnipeg, Manitoba, in 1955. This may be an indication that the geographic range of race 6 has increased.

A variant of race 5, designated as 5A, was identified from rusted Saia oats adjacent to barberry at Blacksburg, Virginia. This isolate, which can attack Saia in the seedling stage, is noteworthy, as Saia had previously been resistant to all United States races to which it has been tested. Race 5A could not be differentiated from race 5 on the standard differentials and on 10 additional supplemental differentials. During 1954-55, Saia was used as a supplemental variety in the physiologic-race survey. It was resistant to all isolates identified and ranged in reaction from highly resistant to mesothetic.

Eleven varieties or lines of oats of the same or equivalent genetic origin as those used in 1954 were added to the 3 standard differential varieties in all identifications made in 1955. Saia was the only promising differential found among these varieties.

PLANT PEST CONTROL BRANCH AND FIELD CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE, IN COOPERATION WITH THE MINNESOTA AGRICULTURAL EXPERIMENT STATION, ST. PAUL, MINNESOTA

Table 1. Physiologic races of Puccinia graminis tritici isolated from uredial collections in the United States in 1955.

State	Race and number of times isolated																												Total number of--		
	1*	11	14[a]	15	15B	21	23[a]	24	17-29	29	33*	35*	36*	38	38-48	44*	48A	56	59*	59A*	59B*	59C*	81[a]	118[a]	122	125[a]	139*	186[a]	Isolates	Races	Collections
California	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	3
Colorado	-	-	-	-	8	-	-	-	1	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	13	4	10
Florida	-	1	-	-	-	-	-	-	4	2	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	11	4	9
Idaho	-	3	-	-	-	-	-	-	2	-	-	-	2	-	2	2	4	1	-	-	-	1	-	-	-	-	-	-	17	8	12
Illinois	-	1	-	-	30	-	-	-	3	2	-	-	-	-	-	-	2	16	-	-	-	-	-	-	-	-	-	-	54	6	39
Indiana	-	-	-	-	22	-	-	-	25	3	-	-	-	-	-	-	2	8	-	-	-	-	-	-	-	-	-	-	60	5	40
Iowa	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	15	2	13
Kansas	-	-	-	-	9	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	11	3	10
Kentucky	-	-	-	-	2	-	-	-	5	3	-	-	-	2	-	-	4	6	-	-	-	-	-	-	-	-	-	-	22	6	14
Michigan	-	-	-	-	11	-	-	-	8	2	-	-	-	1	-	-	1	3	-	-	-	-	-	-	-	1	-	-	27	7	14
Minnesota	-	-	-	-	33	-	-	-	5	3	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	44	4	35
Mississippi	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2
Missouri	-	-	-	-	28	1	-	-	11	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	45	4	33
Montana	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	4	2	3
Nebraska	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	22	2	19
New York	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	1	-	1	-	-	-	-	1	6	6	3
North Carolina	-	2	-	-	2	-	-	-	-	-	-	-	-	2	-	-	-	8	-	-	-	-	-	-	-	-	-	-	14	4	13
North Dakota	-	1	-	1	56	-	-	-	3	2	-	-	-	-	-	-	1	8	-	-	-	-	-	-	-	-	-	-	72	7	64
Ohio	-	1	-	-	24	-	-	-	18	10	-	-	-	1	-	-	6	11	-	-	-	-	-	-	-	-	-	-	71	7	47
Oklahoma	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	12	2	10
Pennsylvania	-	-	-	-	4	-	-	-	4	2	-	-	-	2	-	-	-	7	1	-	-	-	-	-	-	-	-	-	20	6	13
South Carolina	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3	2	3
South Dakota	-	-	-	-	29	-	-	-	-	1	-	-	-	1	-	-	1	4	-	-	-	-	-	-	-	-	-	-	36	5	31
Tennessee	-	-	-	-	-	-	-	-	3	1	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	8	4	6
Texas	-	1	-	-	38	-	-	1	7	4	-	-	-	1	-	-	10	7	-	-	-	-	-	-	1	-	-	-	70	9	61
Virginia	-	3	3	-	6	-	1	-	-	4	1	-	-	6	-	1	2	16	4	4	-	1	-	1	-	1	1	-	55	16	42
Washington	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
West Virginia	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	2	1	-	-	-	-	-	-	-	6	5	3
Wisconsin	-	-	-	1	10	-	-	-	5	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	17	4	11
Wyoming	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	14	2	10
Totals	1	16	3	2	356	1	1	1	106	44	2	1	2	16	2	3	35	138	7	7	2	2	1	1	1	2	1	1	755	28	574
Percentage of isolates	0.1	2.1	0.4	0.3	47.2	0.1	0.1	0.1	14.1	5.8	0.3	0.1	0.3	2.1	0.3	0.4	4.7	18.3	0.9	0.9	0.3	0.3	0.1	0.1	0.1	0.3	0.1	0.1			

*Races that were also isolated directly from aecial collections.

[a]There is evidence that these races originated on barberry in the locality where they were collected.

Table 2. Physiologic races of Puccinia graminis tritici isolated from aecial collections in the United States in 1955.

State	Race and number of times isolated																									Total number of		
	1	11	15	15B	17-29	19	21	24	33	34	35	36	44	48A	59	59A	59B	59C	69	111	116	117	139	147	177	Isolates	Races	Collections
Iowa	1	1	-	-	1	-	1	1	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	9	9	7
Illinois	-	2	-	-	1	-	-	-	-	-	1	1	-	-	-	-	1	-	-	1	-	-	-	-	-	7	6	3
Minnesota	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	1	-	1	-	-	5	5	4
Oregon	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	1	3	3	1
Pennsylvania	-	-	1	1	-	-	-	-	1	-	-	-	1	-	1	2	-	-	-	-	-	-	1	-	1	9	8	6
Virginia	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2	-	2	-	-	-	-	1	-	9	6	4
Wisconsin	-	-	-	1	1	1	-	-	-	1	-	-	-	-	-	-	-	1	-	4	-	-	-	-	-	9	6	6
Totals	1	4	2	2	3	1	1	1	1	2	1	2	2	1	4	3	3	1	2	6	1	1	2	2	2	51	25	31
Percentage	2.0		3.9		5.9		2.0		2.0		2.0		3.9		7.8		5.9		3.9		2.0		3.9		3.9			
of isolates		7.8		3.9		2.0		2.0		3.9		3.9		2.0		5.9		2.0		11.6		2.0		3.9		100.0		

Table 3. Physiologic races of Puccinia graminis avenae isolated from uredial collections in the United States in 1955

State	Race and number of times isolated							Total number of		
	2	5	6	7	7A	8	13	Iso-lates	Races	Collec-tions
Arkansas	1	-	-	1	-	-	-	2	2	1
California	1	-	-	-	-	-	-	1	1	1
Florida	1	-	-	-	-	5	-	6	2	5
Georgia	2	-	-	2	1	1	-	6	4	3
Idaho	1	-	-	-	-	-	-	1	1	1
Illinois	3	-	-	33	-	1	-	37	3	34
Indiana	1	-	-	13	1	-	-	15	3	14
Iowa	3	-	-	46	3	2	-	54	4	51
Kansas	4	-	-	8	1	-	-	13	3	11
Kentucky	2	-	-	11	-	-	-	13	2	11
Louisiana	2	-	-	1	-	-	-	3	2	2
Maine	-	-	-	-	-	1	2	3	2	2
Michigan	7	-	-	34	-	2	-	43	3	35
Minnesota	3	-	-	23	2	6	-	34	4	30
Mississippi	2	-	-	2	-	-	-	4	2	4
Missouri	3	1	1	12	3	6	-	26	6	22
Montana	-	-	-	4	1	3	-	8	3	4
Nebraska	-	-	-	2	1	1	-	4	3	4
New Hampshire	-	-	-	-	-	1	-	1	1	1
New York	-	-	2	12	-	1	-	15	3	12
North Dakota	5	-	-	21	5	15	-	46	4	33
Ohio	-	-	-	26	-	-	-	26	1	26
Oklahoma	3	-	-	10	1	-	-	14	3	11
Pennsylvania	-	-	1	17	2	1	-	21	4	18
South Carolina	2	-	-	1	-	-	-	3	2	2
South Dakota	3	-	-	21	2	4	-	30	4	25
Tennessee	1	-	-	-	-	-	-	1	1	1
Texas	8	8	-	12	-	-	-	28	3	24
Virginia	3[a]	3	-	3	-	-	-	9	3	8
Wisconsin	-	-	-	26	-	11	-	37	2	33
Wyoming	-	-	-	2	-	2	-	4	2	2
Total	61	12	4	343	23	63	2	508	7	431
Percentage of isolates	12.0	2.4	0.8	67.5	4.5	12.4	0.4	100.0		

[a]Isolated also from 2 aecial collections

THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
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IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

A CHECK LIST OF NORTH AMERICAN RUST FUNGI (UREDINALES)

Supplement 240

December 15, 1956

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch Plant Industry Station, Beltsville, Maryland

A CHECK LIST OF NORTH AMERICAN RUST FUNGI (UREDINALES)[1]

George B. Cummins[2] and John A. Stevenson[3]

Plant Disease Reporter
Supplement 240 December 15, 1956

INTRODUCTION

The International Rules of Botanical Nomenclature, previous to the Stockholm Congress of 1950, were ambiguous as to what constituted the basis for setting up names for the rust fungi (Uredinales). The 1935 edition of the Rules states (Art. 57) that "The perfect state is that . . . . . . which ends in the teleutospore or its equivalent in the Uredinales." There was a diversity of opinion as to whether the uredial stage was to be considered as "the equivalent" of the telial stage for the purposes of establishing legitimate names for the rust fungi.

This situation was cleared up by the Stockholm Congress of 1950 which adopted the following wording which appears in Article 69 of the International Code of Botanical Nomenclature (1952) "The perfect state is that which consists of spores giving rise to basidia in the Uredinales." This rule definitely relieves Uredo names of any responsibility in the setting up of valid perfect state names for the rust fungi. No basic changes were made in this rule by the 8th Congress at Paris in 1954.

Inasmuch as many of the names heretofore applied to the rust fungi of North America have been in fact based on Uredo names, or other imperfect state names, it seems desirable to present a list of names which conform, to the best of our belief, to the provisions of the Code regulating such names.

It is of interest to note that similar steps have been taken for the rust fungi of the Scandinavian countries by Hylander, Jørstad and Nannfeldt (Enumeratio Uredinearum Scandinavicarum. Opera Botanica Vol. 1, No. 1. 1953). We have made free use of their publication in the present paper, since a number of the species occur in both areas.

In the list which follows, we have attempted to account for all rust species recognized in "North American Flora" and "The Manual of Rusts of the United States and Canada", as well as all species which have been reported for North America since the publication of these works.

Recognized names are given in caps and where these names are not those used in the two works just cited, explanations for the proposed changes are given. Only pertinent synonyms are cited. Distribution and hosts are given for species not covered in "North American Flora" or the "Manual."

We wish to acknowledge much helpful advice received from Dr. Donald P. Rogers, Curator, New York Botanical Garden, on the nomenclatorial problems involved in preparing this list.

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[1]Cooperative investigations between the Purdue University Agricultural Experiment Station and the Plant Disease Epidemics and Identification Section, Horticultural Crops Research Branch, Agricultural Research Service, United States Department of Agriculture. Journal Paper No. 996, of the Purdue University Agricultural Experiment Station. Contribution from the Department of Botany and Plant Pathology.

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NOTES

1: Under the provisions of Art. 69 of the International Code, as quoted in the introduction, a binomial for a perfect state (telial) is set up "de novo" without reference to any corresponding earlier imperfect state epithet. Thus, for instance, to take the first example in the list, the epithet Achrotelium lucumae is correctly attributed to Cummins alone and not to (Arth. et J. R. Johnston) Cumm. which would indicate a transfer from the Uredo name. Many similar cases will be noted throughout this list.

2: A single asterisk (*) indicates a new record for the United States and Canada. Not listed in Arthur's Manual.

3: A double asterisk (**) indicates a new record for North America, other than the United States or Canada. Not listed in North American Flora.

CHECK LIST OF NORTH AMERICAN RUST FUNGI

*ACHROTELIUM LUCUMAE Cumm. Mycologia 48: 601. 1956.
Uredo lucumae Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 169. 1918. See NOTE 1, page 110.
Uraecium lucumae Arth. Bull. Torr. Bot. Club 60: 467. 1933.
Achrotelium lucumae Cumm. Bull. Torr. Bot. Club 67: 70. 1940. Nomen nudum.
On Lucuma nervosa A. DC.: Florida.

AECIDIUM ABSCEDENS Arth. Mycologia 7: 315. 1915.

Aecidium aesculi Ell. et Kell.: See PUCCINIA ANDROPOGONIS Schw.

AECIDIUM ALBICANS Arth. et Holw. in Arth. Mycologia 10: 146. 1918.

AECIDIUM AMPLIATUM Jacks. et Holw. in Arth. Mycologia 10: 148. 1918.

AECIDIUM ANOGRAE Arth. Bull. Torr. Bot. Club 28: 664. 1901.

AECIDIUM ANONAE P. Henn. Hedwigia 34: 100. 1895.

AECIDIUM ANTHERICICOLA Arth. Bull. Torr. Bot. Club 45: 149. 1918.

Aecidium apocyni Schw.: See PUCCINIA SMILACIS Schw.

**AECIDIUM ARCHIBACCHARIDIS Cumm. Bull. Torr. Bot. Club 68: 471. 1941.
On Archibaccharis serratifolius (H. B. K.) Blake: Guatemala.

Aecidium arctoum Arth.: See PUCCINIA CARICIS-SHEPHERDIAE J. J. Davis

AECIDIUM ARCULARIUM Arth. Bull. Torr. Bot. Club 47: 478. 1920.

AECIDIUM ARGITHAMNIAE Arth. Bull. Torr. Bot. Club 33: 33. 1906.

*AECIDIUM AVOCENSE, Cumm. et Greene in Greene Trans. Wis. Acad. Sci., Arts, Letters 43: 176. 1954.
On Callirhoe triangulata (Leavenw.) Gray: Wisconsin. (Probably the aecial stage of Puccinia avocensis Cumm. et Greene)

AECIDIUM BATESII Arth. Bull. Torr. Bot. Club 47: 479. 1920.

**AECIDIUM BELIZENSE Mains Contrib. Univ. Mich. Herb. 1: 14. 1939.
On Ipomoea sp.: British Honduras.

AECIDIUM BETHELI Arth. Bull. Torr. Bot. Club 47: 476. 1920.

AECIDIUM BOEHMERIAE Arth. Bull. Torr. Bot. Club 34: 590. 1907.

AECIDIUM BORRERIAE Pat. ex Duss in Enum. Champ. Guad. p. 7. 1903.

AECIDIUM BORRICHIAE Syd. Hedwigia Beibl. 40: 129. 1901.

AECIDIUM BOURRERIAE Holw. ex Arth. Bull. Torr. Bot. Club 46: 123. 1919.

AECIDIUM BOUVARDIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 36. 1897.

**AECIDIUM BRASILIENSE Diet. Hedwigia 36: 35. 1897.
On Cordia cana Mart. et Gal. : Honduras.

Aecidium butlerianum Rosen et Arth. : See CUMMINSIELLA TEXANA (Holw. et Long) Arth.

AECIDIUM BYRSONIMATIS P. Henn. Hedwigia 34: 101. 1895.

AECIDIUM CAMPANULASTRI G. W. Wils. Proc. Iowa Acad. 17: 74. 1911.

AECIDIUM CANNONII Griff. Bull. Torr. Bot. Club 34: 210. 1907.

**AECIDIUM CANTENSE Arth. Bull. Est. Exp. Agr. Soc. Nat. Agr. Peru 2: 10. 1929.
On Solanum tuberosum L. : Honduras.

AECIDIUM CHAMAECRISTAE Arth. Bull. Torr. Bot. Club 46: 123. 1919.

**AECIDIUM COLLAPSUM Mains Contrib. Univ. Mich. Herb. 1: 15. 1939.
On Wedelia parviceps Blake: British Honduras.

Aecidium collinsiae Ell. et Ev. : See PUCCINIA COLLINSIAE P. Henn.

AECIDIUM COLUMBIENSE Ell. et Ev. Erythea 1: 206. 1893.

AECIDIUM CONSPERSUM J. J. Davis Paras. Fungi Wis., p. 62. 1942.
Aecidium sparsum J. J. Davis Trans. Wis. Acad. Sci. 24: 292. 1929. (non Hazl. 1874).
On Houstonia longifolia Gaertn. and Galium tinctorium L. : Wisconsin.

Aecidium conspicuum Arth. : See PUCCINIA CONSPICUA Arth.

AECIDIUM CORDIAE P. Henn. in Bres., P. Henn. et Magn. Bot. Jahrb. 17: 491. 1893.

AECIDIUM CYRILLAE Arth. Bull. Torr. Bot. Club 45: 150. 1918.

AECIDIUM DAHLIAE Syd. Ann. Mycol. 18: 155. 1920.

**AECIDIUM DAHLIAE-MAXONII Cumm. Bull. Torr. Bot. Club 70: 69. 1943.
On Dahlia maxonii Saff. : Guatemala.

**AECIDIUM DOMINGENSE Kern et Cif. Mycologia 22: 116. 1930.
On Baccharis myrsinites (Lam.) Pers. : Dominican Republic.

Aecidium dominicanum Gonz. Frag. et Cif. : See COLEOSPORIUM IPOMOEAE (Schw.) Burr.

**AECIDIUM EVANSII P. Henn. Engler's Bot. Jahrb. 41: 272. 1908.
On Lippia berlandierii Shau. : Mexico.

AECIDIUM FARAMEAE Arth. Bull. Torr. Bot. Club 42: 592. 1915.

AECIDIUM FAVACEUM Arth. Mycologia 7: 254. 1915.

**AECIDIUM FUCHSIAE Jacks. et Holw. in Jacks. Mycologia 24: 97. 1932.
On Fuchsia minutiflora Hemsl. : Guatemala.

Aecidium graebnerianum P. Henn. : See PUCCINIA PRAEGRACILIS Arth.

AECIDIUM GUATEMALENSE Kern et Kell. Jour. Mycol. 13: 23. 1907.

AECIDIUM HESLERI Arth. Bull. Torr. Bot. Club 60: 476. 1933.

**AECIDIUM HISPANIOLAE Kern, Cif. et Thurston Ann. Mycol. 31: 4. 1933.
On Solanum rugosum Dunal: Dominican Republic.

AECIDIUM HUALTATINUM Speg. Bol. Acad. Cien. Cordoba 11: 184. 1888.

Aecidium indecisum Arth. : See PUCCINIA EATONIAE Arth.

AECIDIUM INSULSUM Arth. No. Amer. Flora 7: 637. 1924.

AECIDIUM IVAE Jacks. Ind. Acad. Sci. 1917: 373. 1918.

AECIDIUM IXORAE Arth. Bull. Torr. Bot. Club 47: 473. 1920.

AECIDIUM JACQUEMONTIAE Ell. et Ev. Jour. Mycol. 8: 11. 1902.

AECIDIUM KEERLIAE Arth. Bull. Torr. Bot. Club 45: 154. 1918.

AECIDIUM LANTANAE Mayor Mem. Soc. Neuch. Sci. Nat. 5: 567. 1913.
Probably distinct from A. verbenae Speg. under which it is included in No. Amer. Flora.

ACIDIUM LEPORINUM Arth. Bull. Torr. Bot. Club 37: 578. 1910.

AECIDIUM LIABI Mayor Mem. Soc. Neuch. Sci. Nat. 5: 576. 1913.

AECIDIUM LIBERTUM Arth. Bull. Torr. Bot. Club 37: 580. 1910.

AECIDIUM LIGUSTICI Ell. et Ev. Bull. Torr. Bot. Club 11: 73. 1884.

AECIDIUM LINI Dearn. et House Bull. N. Y. State Mus. 179: 26. 1915.

AECIDIUM LORANTHI Thuem. ex Lorentz in Veg. Entre Rios, p. 3. 1878.

** AECIDIUM LYCIANTHIS Cumm. Bull. Torr. Bot. Club 70: 68. 1943.
On Lycianthes quichensis (Coult. et D. Sm.) Bitter: Guatemala.

AECIDIUM LYCII Arth. No. Amer. Flora 7: 636. 1924.

AECIDIUM MESADENIAE. Arth. Bull. Torr. Bot. Club 47: 479. 1920.

AECIDIUM MEXICANUM Diet. et Holw. in Holw. Bot. Gaz. 24: 36. 1897.

AECIDIUM MIKANIAE P. Henn. Hedwigia 35: 261. 1896.

AECIDIUM MINUTULUM Jacks. ex Bartholomew in No. Amer. Ured. No. 3401. 1926.

AECIDIUM MIRABILIS Diet. et Holw. in Holw. Bot. Gaz. 24: 37. 1897.

AECIDIUM MITELLAE Ell. et Ev. Bull. Torr. Bot. Club 47: 475. 1920.

AECIDIUM MODESTUM Arth. Bull. Torr. Bot. Club 46: 124. 1919.

AECIDIUM MOZINNAE Arth. Bull. Torr. Bot. Club 45: 152. 1918.

AECIDIUM MUTUM Arth. No. Amer. Flora 7: 632. 1924.

Aecidium onobrychidis Burr. : See PUCCINIA ANDROPOGONIS ONOBRYCHIDIS Arth.

AECIDIUM PEREZIAE Arth. Bull. Torr. Bot. Club 45: 153. 1918.

AECIDIUM PHYSALIDIS Burr. Bot. Gaz. 9: 190. 1884.

AECIDIUM PISONIAE Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 161. 1918.

AECIDIUM PLENUM Arth. Bull. Torr. Bot. Club 45: 149. 1918.

AECIDIUM POASENSE Syd. Ann. Mycol. 23: 324. 1925.

Aecidium polygalinum Pk. : See PUCCINIA ANDROPOGONIS POLYGALINA Arth.

AECIDIUM PRAECIPUUM Arth. Bull. Torr. Bot. Club 47: 480. 1920.

AECIDIUM PSYCHOTRIAE P. Henn. Hedwigia 43: 166. 1904.

AECIDIUM PULVERULENTUM Arth. Bull. Torr. Bot. Club 33: 521. 1906.

AECIDIUM REICHEI Diet. Ann. Mycol. 12: 85. 1914.

AECIDIUM RENATUM Arth. Bull. Torr. Bot. Club 47: 477. 1920.

AECIDIUM RESIDUUM Arth. No. Amer. Flora 7: 622. 1924.

*AECIDIUM RUBROMACULANS E. West Mycologia 33: 40. 1941.
On Viburnum obovatum Walt. : Florida.

**AECIDIUM SEBASTIANAE Mains Contrib. Univ. Mich. Herb. 1: 15. 1939.
On Sebastiana standleyana Lundell: British Honduras.

AECIDIUM SERIATUM Arth. et Holw. in Arth. in Amer. Jour. Bot. 5: 541. 1918.

**AECIDIUM SERJANIAE P. Henn. Hedwigia 35: 258. 1896.
On Serjania tailloniana Standl. & L. O. Williams: Honduras.

AECIDIUM SIMPLICIUS Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 162. 1918.

Aecidium smilacis Schw. : See PUCCINIA ARUNDINARIAE Schw.

Aecidium sparsum J. J. Davis: See A. CONSPERSUM J. J. Davis

AECIDIUM STEVIICOLA Arth. Bull. Torr. Bot. Club 45: 154. 1918.

AECIDIUM SUBSIMULANS Arth. et Mains in Arth. Bull. Torr. Bot. Club 47: 475. 1920.

**AECIDIUM TALINI Speg. Rev. Argent. Hist. Nat. 1: 399. 1891.
On Talinum triangulare (Jacq.) Willd. : Guatemala.

AECIDIUM TENERIUS Arth. et Holw. in Arth. Mycologia 10: 147. 1918.

AECIDIUM THENARDIAE Arth. Bull. Torr. Bot. Club 45: 150. 1918.

AECIDIUM THEVETIAE Sacc. Ann. Mycol. 11: 14. 1913.

AECIDIUM TITHYMALI Arth. Bull. Torr. Bot. Club 45: 151. 1918.

AECIDIUM TOURNEFORTIAE P. Henn. Hedwigia 34: 338. 1895.

AECIDIUM TRACYANUM Syd. Hedwigia Beibl. 40: 129. 1901.

AECIDIUM TRIOSTEI Arth. Bull. Torr. Bot. Club 33: 32. 1906.

AECIDIUM TRIUMFETTAE P. Henn. Hedwigia 35: 259. 1896.

*AECIDIUM TURNERAE P. Henn. Hedwigia 43: 171. 1904.
On Piriqueta caroliniana (Walt.) Urb.: Florida.

AECIDIUM VALERIANELLAE Biv. Stirp. Rar. Sic. 4: 28. 1816.
This is the aecial stage of Puccinia gladioli Cast. according to d'Oliveira in Nature 144: 239-240. 1949. The telial stage on Gladiolus is not known in North America.

AECIDIUM VERBENAE Speg. Anal. Soc. Cien. Argent. 9: 174. 1880.
The telial stage as Puccinia elongata Speg. 1880 (non Schroet. 1879) is not known in North America. See also A. lantanae Mayor

AECIDIUM WEDELIAE-HISPIDAE Diet. Ann. Mycol. 20: 294. 1922.

Aecidium xanthoxyli Pk.: See PUCCINIA ANDROPOGONIS XANTHOXYLI Arth.

**AECIDIUM YUCATANENSE Mains Carnegie Inst. Wash. Publ. 461: 105. 1935.
On Hamelia patens Jacq.: Mexico.

Aecidium yuccae Arth.: See PUCCINIA AMPHIGENA Diet.

AECIDIUM ZEPHYRANTHIS Shear Bull. Torr. Bot. Club 29: 454. 1902.

AECIDIUM ZONATUM Sacc. Ann. Mycol. 11: 14. 1913.

Allodus: See PUCCINIA

Ameris rosicola (Ell. et Ev.) Arth.: See PHRAGMIDIUM ROSICOLA (Ell. et Ev.) Arth.

ALVEOLARIA CORDIAE Lagerh. Ber. Deuts. Bot. Ges. 9: 346. 1891.

ANGIOPSORA AMPELOPSIDIS (Diet. et Syd.) Thirum. et Kern Mycologia 41: 288. 1949.
Uredo vitis Thuem. Pilze Weinst., p. 182. 1878. See NOTE 1, p. 110.
Phakopsora ampelopsidis Diet. et Syd. Hedwigia 37: 217. 1898.
Phakopsora vitis Syd. Hedwigia 38: 141. 1899.
Physopella vitis Arth. Sci. Cong. Bot. Vienne, p. 338. 1906.

**ANGIOPSORA AUREA Cumm. Bull. Torr. Bot. Club 83: 221. 1956.
On Panicum olivaceum Hitch. et Chase, P. sphaerocarpon Ell.: Honduras.

ANGIOPSORA CAMELIAE (Mayor) Mains Papers Mich. Acad. Sci., Arts, Letters 22: 154. 1937.
Uredo cameliae Mayor Mem. Soc. Neuch. Sci. 5: 578. 1913.
The type material of this Uredo bears telia, hence the epithet can be credited to Mayor in the "perfect stage" name.
Puccinia cameliae Arth. Mycologia 7: 227. 1915.

*ANGIOPSORA COMPRESSA Mains Mycologia 26: 129. 1934.
Uredo paspalicola P. Henn. Hedwigia 44: 57. 1905.
On Axonopus compressus (Swartz) P. Beauv., Paspalum conjugatum Bergius, P. decumbens Swartz, P. distichophyllum H. B. K., P. elongatum Griseb., P. fasciculatum Willd., P. humboldtiana Fluegge, P. paniculatum L., P. plicatulum Michx., P. stellatum Fluegge, P. squamulatum Fourn., P. trachycauleon Steud., P. virgatum L.: southern U. S. to South America.
Segregated from Puccinia paspalicola Arth. (see P. substriata Ell. et Barth.)

**ANGIOPSORA LENTICULARIS Mains Mycologia 26: 127. 1934.
On Lasiacis divaricata (L.) Hitchc., L. ligulata Hitchc. et Chase, L. ruscifolia (H.B.K.) Hitchc., Panicum arundinariae Trin.: Puerto Rico and Guatemala.

ANGIOPSORA PALLESCENS (Arth.) Mains Mycologia 26: 128. 1934.
Puccinia pallescens Arth. Bull. Torr. Bot. Club 46: 111. 1919.

ANGIOPSORA PHAKOPSOROIDES (Arth. et Mains) Mains Mycologia 26: 128. 1934.
Puccinia phakopsoroides Arth. et Mains Bull. Torr. Bot. Club 46: 112. 1919.

**ANGIOPSORA ZEAE Mains Mycologia 30: 42. 1938.
On Zea mays L.: Dominican Republic, Grenada, Guatemala, Jamaica, Mexico, Puerto Rico, St. Vincent.

APLOPSORA NYSSAE Mains Amer. Jour. Bot. 8: 442. 1921.
Uredo nyssae Ell. et Tracy Jour. Myc. 6: 77. 1890. See NOTE 1, p. 110

**ARTHURIA COLUMBIANA (Kern et Whet.) Cumm. Bull. Torr. Bot. Club 70: 519. 1943.
On Croton gossypifolium Vahl: Costa Rica.

Atelocauda incrustans Arth. et Cum.: See PILEOLARIA INCRUSTANS (Arth. et Cumm.) Thirum. et Kern

BAEODROMUS CALIFORNICUS Arth. Ann. Mycol. 3: 19. 1905.

**BAEODROMUS DOMINICANA (Kern) Thirum. et Kern Mycologia 41: 284. 1949.
Phakopsora dominicana Kern Mycologia 20: 63. 1928.

BAEODROMUS EUPATORII (Arth.) Arth. No. Amer. Flora 7: 125. 1907.

BAEODROMUS HOLWAYI Arth. Ann. Mycol. 3: 19. 1905.

Bitzea ingae (Syd.) Mains: See CHACONIA INGAE (Syd.) Cumm.

BOTRYORHIZA HIPPOCRATEAE Whet. et Olive in Olive et Whet. Amer. Jour. Bot. 4: 47. 1917.

BUBAKIA CROTONIS (Burr.) Arth. Res. Sci. Congr. Bot. Vienne, p. 339. 1906.
Trichobasis crotonis Cke. Grevillea 6: 137. 1878. See NOTE 1, p. 110.
Melampsora crotonis Burr. Bot. Gaz. 9: 189. 1884.
Phakopsora crotonis Arth. Bull. Torr. Bot. Club 44: 508. 1917.

BUBAKIA ERYTHROXYLONIS Cumm. Mycologia 48: 601. 1956.
Uredo erythroxylonis Graz. Bull. Soc. Myc. France 7: 152. 1891.
See NOTE 1, p. 110
Bubakia erythroxylonis Cumm. Bull. Torr. Bot. Club 67: 69. 1940.
Lacks the Latin diagnosis required by Art. 44 and 53.

BUBAKIA MEXICANA Arth. No. Amer. Flora 7: 104. 1907.
Phakopsora mexicana Arth. Bull. Torr. Bot. Club 44: 508. 1917.

Bullaria: See PUCCINIA

CAEOMA DUBIUM C. A. Ludwig Phytopath. 5: 281. 1915.

*CAEOMA FAULLIANA Hunter Jour. Arnold Arb. 17: 118. 1936.
On Abies lasiocarpa (Hook.) Nutt.: Alberta.

*CAEOMA TORREYAE Bonar Mycologia 43: 62. 1951.
On Torreya californica Torr.: California.

Calliospora: See UROPYXIS

CALLIOSPORA FARLOWII Arth. Bot. Gaz. 39: 39. 1905.
Calliospora is a synonym of Uropyxis. This species belongs in Uropyxis but the need for the transfer was overlooked by Cummins (Mycologia 48: 601-608. 1956).

CEROTELIUM ALIENUM (Syd. et Butl.) Arth. No. Amer. Flora 7: 698. 1925.

CEROTELIUM CANAVALIAE Arth. Bull. Torr. Bot. Club 33: 30. 1906.

Cerotelium desmium (Berk. et Br.) Arth.: See PHAKOPSORA GOSSYPII (Arth.) Hirat. f.

CEROTELIUM DICENTRAE Mains et H. W. Anderson in Mains Amer. Jour. Bot. 8: 445. 1921.
Aecidium dicentrae Trel. Trans. Wis. Acad. Sci. 6: 136. 1884.
See NOTE 1, p. 110

CEROTELIUM FICI (Butl.) Arth. Bull. Torr. Bot. Club 44: 509. 1917.
Uredo fici Cast. in Desm. Pl. Crypt. (Fasc. 34) No. 1662. 1848.
See NOTE 1, p. 110
Kuehneola fici Butl. Ann. Mycol. 12: 76. 1914. The first name based on telia.

**CHACONIA ALUTACEA Juel in Bihang K. Sv. Vet.-Akad. Handl. 23: 12. 1897.
On Pithecolobium recordii (Britt. et Rose) Standl.: British Honduras.

CHACONIA INGAE (Syd.) Cumm. Mycologia 48: 602. 1956.
Ravenelia ingae Arth. No. Amer. Flora 7: 132. 1907. Telia not described.
Maravalia ingae Syd. Mycologia 17: 257. 1925. Telia were first described under this name.
Maravalia utriculata Syd. Ann. Mycol. 23: 314. 1925.
Bitzea ingae Mains Mycologia 31: 38. 1939.

Chaconia texensis Arth. No. Amer. Flora 7: 734. 1926. Not a rust.

**CHRYSELLA MIKANIAE Syd. Ann. Mycol. 24: 292. 1926.
On Mikania hirsutissima DC.: Costa Rica.

CHRYSOCELIS LUPINI Lagerh. et Diet. ex Mayor Mem. Soc. Neuch. Sci. Nat. 5: 542. 1913.

CHRYSOCYCLUS CESTRI (Diet. et P. Henn.) Syd. Ann. Mycol. 23: 322. 1925.
Puccinia cestri Diet. et P. Henn. Hedwigia 41: 295. 1902.
Chrysopsora cestri (Diet. et P. Henn.) Arth. Bull. Torr. Bot. Club 51: 53. 1924.

CHRYSOMYXA ARCTOSTAPHYLI Diet. Bot. Gaz. 19. 303. 1894.

Chrysomyxa cassandrae (Pk. et G. W. Clint.) Tranz. See CHRYSOMYXA LEDI DBy. var. CASSANDRAE (Pk. et G. W. Clint.) Savile

CHRYSOMYXA CHIOGENIS Diet. Bot. Gaz. 19: 303. 1894.
Aecia on Picea glauca Moench. and P. mariana (Mill.) B.S.P. in Ontario (Faull)[4]

CHRYSOMYXA EMPETRI Schroet. ex Cumm. Mycologia 48: 602. 1956.
Uredo empetri Pers. ex DC. Fl. Fr. 6: 87. 1815. See NOTE 1, p. 110.
Thecopsora empetri Karst. Bidr. Finlands Nat. Folk 31: 143. 1879. Based on uredia.
Chrysomyxa empetri Schroet. in Cohn Krypt. Fl. Schles. 3 (1): 372. 1887. Based on uredia.
Chrysomyxa empetri Schroet. ex Jørstad Kgl. Norske Vidensk. Selsk. Skr. 1935. (38): 51. 1936. Telia described, but without Latin diagnosis.

CHRYSOMYXA ILICINA (Arth.) Arth. Manual Rusts U. S. and Canada, p. 31. 1934.
Aecidium ilicinum Ell. et Ev. Bull. Torr. Bot. Club 24: 284. 1897. See NOTE 1, p. 110
Melampsoropsis ilicina Arth. No. Amer. Flora 7: 688. 1925. Telia first described.

CHRYSOMYXA LEDI Dby. Bot. Zeit. 37: 809. 1879.
Uredo ledi Alb. et Schw. Consp. Fung., p. 125. 1805. See NOTE 1, p. 110.

CHRYSOMYXA LEDI DBy. var. CASSANDRAE (Pk. et G. W. Clint.) Savile Can. Jour. Res. C, 28: 324. 1950.
Uredo cassandrae Pk. et G. W. Clint. in Pk. Ann. Rept. N. Y. State Mus. 30: 54. 1878. Savile (l.c.) points out that the lectotype of this Uredo bears telia, hence the specific epithet is valid for transfer to form part of the telial epithet.
Chrysomyxa cassandrae (Pk. et G. W. Clint.) Tranz. Trav. Soc. Nat. St. Petersb., Sect. Bot. 23: 28. 1893.

CHRYSOMYXA LEDI DBy. var. GLANDULOSI Savile Can. Jour. Bot. 33: 489. 1955.
On Picea engelmanii (Parry) Engelm.: British Columbia.

CHRYSOMYXA LEDI DBy. var. GROENLANDICI Savile Can. Jour. Bot. 33: 490. 1955.
On Ledum groenlandicum Oeder: Canada, Michigan, New Hampshire.

CHRYSOMYXA LEDI DBy. var. LEDI
Savile sets up this var. (Can. Jour. Res. C, 28: 324. 1950) as provided in Art. 35 of the Inter. Code.

CHRYSOMYXA LEDI DBy var. RHODODENDRI (DBy.) Savile Can. Jour. Bot. 33: 491. 1955.
Chrysomyxa rhododendri DBy. Bot. Zeit. 37: 809. 1879.
Chrysomyxa ledi (Alb. et Schw.) DBy. var. rhododendri (DC.) Savile Can. Jour. Res., C, 28: 325. 1950. This varietal name having been based on an imperfect state name is not valid.
On Rhododendron lapponicum L.: Manitoba, British Columbia, Newfoundland; Rhododendron spp: Washington.

CHRYSOMYXA LEDI DBy. var. VACCINII Ziller in Savile Can. Jour. Bot. 33: 492. 1955.
On Vaccinium parvifolium Smith: British Columbia.

CHRYSOMYXA LEDICOLA Lagh. Tromsø Mus. Aarsh. 16: 119. 1893.
Uredo ledicola Pk. Ann. Rept. N.Y. State Mus. 25: 90. 1873. See NOTE 1, p. 110.

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[4]For additional hosts and extended ranges of various species of Chrysomyxa see Savile, Canadian Jour. Res. C. 28: 318-330, 1950 and Canadian Jour. Bot. 33: 487-496, 1955.

CHRYSOMYXA MONESIS Ziller Can. Jour. Bot. 32: 435. 1954
On Picea sitchensis (Bong.) Carr., Moneses uniflora (L.) Gray and var. reticulata (L.) Gray: Alaska, British Columbia, Washington. This species was segregated from C. pyrolae (DC.) Rostr. of Arthur's Manual. See C. pirolata Wint.

CHRYSOMYXA PIPERIANA Sacc. et Trott. ex Cumm. Mycologia 48: 602. 1956.
Melampsoropsis piperiana Arth. No. Amer. Flora 7: 120. 1907.
Based on uredia.
Chrysomyxa piperiana Sacc. et Trott. in Sacc. Syll. Fung. 21: 716. 1912.
Based on uredia.
Peridermium parksianum Faull Jour. Arnold Arb. 15: 86. 1934.
Chrysomyxa piperiana Sacc. et Trott. ex Faull Jour. Arnold Arb. 17: 110. 1936. Telia first described, but without Latin diagnosis.

CHRYSOMYXA PIROLATA Wint. in Rab. Krypt.-Fl. ed. 2, I, 1: 250. 1882.
Uredo pirolata Körnicke Hedwigia 16: 28. 1877. See NOTE 1, p. 110.
Chrysomyxa pyrolae (DC.) Rostr. Bot. Centralbl. 5: 127. 1877.
Nomen nudum.

Chrysomyxa pyrolae (DC.) Rostr.: See C. PIROLATA Wint.

CHRYSOMYXA ROANENSIS (Arth.) Arth. Manual Rusts U. S. and Canada, p. 35. 1934.
Melampsoropsis roanensis Arth. Bull. Torr. Bot. Club 49: 190. 1922.

CHRYSOMYXA WEIRII Jacks. Phytopath. 7: 353. 1917.

CHRYSOMYXA WORONINII Tranz. Centralbl. II, 11: 106. 1903.
On Ledum groenlandicum Oeder, Ledum palustre L. var. decumbens Ait., Picea glauca (Moench.) Voss, Picea mariana (Mill.) B.S.P.: Newfoundland, Nova Scotia, British Columbia, Quebec, Yukon, Alaska.

Chrysopsora cestri (Diet. et P. Henn.) Arth.: See CHRYSOCYCLUS CESTRI (Diet. et P. Henn.) Syd.

CIONOTHRIX CUPANIAE Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 115. 1918.

CIONOTHRIX PRAELONGA (Wint.) Arth. No. Amer. Flora 7: 124. 1907.

Coleosporium adenocaulonis Jacks. See UREDO ADENOCAULONIS (Jacks.) Cumm.

COLEOSPORIUM ANCEPS Diet. et Holw. in Holway Bot. Gaz. 31: 337. 1901.

COLEOSPORIUM APOCYNACEUM Cke. Hedwigia 17: 38. 1878.

Coleosporium aridum Jacks.: See UREDO ARIDA (Jacks. ex Arth.) Cumm.

COLEOSPORIUM ASTERUM (Diet.) Syd. Ann. Mycol. 12: 109. 1914.
Coleosporium solidaginis Thuem. Bull. Torr. Bot. Club 6: 216. 1878.
This name is based on uredia only.
Stichopsora asterum Diet. Bot. Jahrb. 28: 565. 1899. This is the first valid telial name.

COLEOSPORIUM BEGONIAE Arth. No. Amer. Flora 7: 86. 1907.

COLEOSPORIUM CAMPANULAE Lév. ex Kickx Fl. Flandres 2: 54. 1867.
Telia first described.
Uredo campanulae Pers. Syn. Meth. Fung., p. 217. 1801. See NOTE 1, p. 110.
Coleosporium campanulae Lev. Ann. Sci. Nat. III. 8: 373. 1847.
Telia not described.

Hylander, Jørstad and Nannfeldt (loc. cit, p. 8) consider this a form of C. tussilaginis (Pers.) Lév. in Orbigny Dict. Univ. Hist. Nat. 12: 786. 1849.

Coleosporium carneum [Bosc] Jacks.: See COLEOSPORIUM VERNONIAE Berk. et Curt.

*COLEOSPORIUM CROWELLII Cumm. Phytopath. 28: 523. 1938.
On Pinus edulis Engelm., P. flexilis James: Arizona, Colorado, New Mexico.

COLEOSPORIUM DAHLIAE Arth. Bot. Gaz. 40: 197. 1905.

COLEOSPORIUM DELICATULUM Hedgc. et Long ex Arth. No. Amer. Flora 7: 657. 1924.
Peridermium delicatulum Arth. et Kern Bull. Torr. Bot. Club 33: 412. 1906.
Coleosporium delicatulum Hedgc. et Long Phytopath. 3: 250. 1913.
No telia present, hence the binomial is not valid.

Coleosporium domingensis (Berk.) Arth.: See C. PLUMIERAE Pat.

COLEOSPORIUM ELEPHANTOPODIS Thuem. Myc. Univ. No. 953. 1878.
Uredo elephantopodis Schw. Schr. Nat. Ges. Leipzig 1: 70. 1822.
See NOTE 1, p. 110.

COLEOSPORIUM EUPATORII Arth. ex Cumm. Mycologia 48: 603. 1956.
Coleosporium eupatorii Arth. Bull. Torr. Bot. Club 33: 31. 1906.
Based on uredia.
Coleosporium eupatorii Arth. ex Tai Farlowia 3: 101. 1947. Telia first described, but without Latin diagnosis.

COLEOSPORIUM HELIANTHI (Schw.) Arth. No. Amer. Flora 7: 93. 1907.
Caeoma helianthi Schw. Trans. Amer. Phil. Soc. II, 4: 291. 1832.
Arthur and Bisby (Proc. Amer. Phil. Soc. 57: 197. 1918.) report telia on the type of this species.

COLEOSPORIUM INCONSPICUUM Hedgc. et Long ex Arth. No. Amer. Flora 7: 659. 1924.
Coleosporium inconspicuum Hedgc. et Long Phytopath. 3: 250. 1913.
Telia not present.

COLEOSPORIUM IPOMOEAE (Schw.) Burr. Bull. Ill. Lab. Nat. Hist. 2: 217. 1885.
Uredo ipomoeae Schw. Schr. Nat. Ges. Leipzig 1: 70. 1822. Arthur and Bisby (Proc. Amer. Phil. Soc. 57: 194. 1918.) report telia on the type of this species.
Aecidium dominicanum Gonz. Frag. et Cif. Bol. R. Soc. Esp. Hist. Nat. 26 : 249. 1926. (based on uredia.)

COLEOSPORIUM JONESII (Pk.) Arth. Manual Rusts U. S. and Canada, p. 37. 1934.
Uredo jonesii Pk. Bull. Torr. Bot. Club 12: 36. 1885. Cummins finds telia on the type of this species.
Coleosporium ribicola Arth. No. Amer. Flora 7: 86. 1907.

COLEOSPORIUM LACINIARIAE Arth. No. Amer. Flora 7: 90. 1907.

COLEOSPORIUM MADIAE (Syd.) Arth. No. Amer. Flora 7: 92. 1907.
Coleosporium madiae Cke. Grev. 7: 102. 1879. Based on uredial state only
Stichopsora madiae Syd. Ann. Mycol. 2: 30. 1904. Telia first described.

COLEOSPORIUM MENTZELIAE (Diet. et Holw.) Arth. No. Amer. Flora 7: 86. 1907.

COLEOSPORIUM MINUTUM Hedgc. et Hunt in Hedgc., Hunt et Hahn Mycologia 12: 187. 1920.

COLEOSPORIUM OCCIDENTALE Arth. No. Amer. Flora 7: 94. 1907.

COLEOSPORIUM PARAPHYSATUM Diet. et Holw. in Holw. Bot. Gaz. 31: 337. 1901.

COLEOSPORIUM PINICOLA (Arth.) Arth. Manual Rusts U. S. and Canada, p. 46. 1934.
Gallowaya pinicola Arth. Bull. Torr. Bot. Club 48: 36. 1921.
Coleosporium pini Gall. (Jour. Myc. 7: 44. 1891) is not tenable, being a later homonym of C. pini Lagh. 1889.

COLEOSPORIUM PLUMIERAE Pat. Bull. Soc. Mycol. France 18: 178. 1902.
Uredo domingensis Berk. Ann. Mag. Nat. Hist. II, 9: 200. 1852.
Coleosporium domingense Arth. Amer. Jour. Bot. 5: 329. 1918. This name, usually cited for this species, is based on the above Uredo name, hence is not valid.

COLEOSPORIUM REICHEI Diet. Ann. Mycol. 21: 341. 1923.
Synomyces reichei (Diet.) Arth. No. Amer. Flora 7: 661. 1924.

Coleosporium ribicola Arth.: See C. JONESII Pk.

COLEOSPORIUM SENECIONIS Fr. ex Kickx Fl. Flandres 2: 53. 1867.
Uredo farinosa β senecionis Pers. Syn. Meth. Fung., p. 218. 1801. See NOTE 1, p. 110.
Coleosporium senecionis Fr. Summa Veg. Scand., p. 512. 1849. Based on Persoon's uredial name.
Hylander, Jørstad, and Nannfeldt (loc. cit., p. 11) consider this species a form of C. tussilaginis (Pers.) Lév.

Coleosporium solidaginis Thuem.: See C. asterum (Diet.) Syd.

COLEOSPORIUM SONCHI (Strauss) Lév. ex Tul. Ann. Sci. Nat. Bot. IV, 2: 190. 1854.
Uredo sonchi-arvensis Pers. Syn. Meth. Fung., p. 217. 1801. Uredia only.
Uredo tremellosa var. sonchi Strauss Ann. Wetter. Ges. 2: 90. 1810. The type specimen here contains telia.
Coleosporium sonchi-arvensis Lév. in Berk. Outline Brit. Fung., p. 333. 1860. Based on an uredial name.
Hylander, Jørstad, and Nannfeldt (loc. cit., p. 11) consider this species a form of C. tussilaginis (Pers.) Lév.

Coleosporium sonchi-arvensis (Pers.) Lév.: See C. SONCHI (Strauss) Lév. ex Tul.

Coleosporium spigeliae Arth. : See UREDO SPIGELIAE (Arth.) Cumm.

COLEOSPORIUM STEVIAE Arth. Bot. Gaz. 40: 197. 1905.

COLEOSPORIUM TEREBINTHINACEAE Arth. No. Amer. Flora 7: 93. 1907.
Uredo terebinthinaceae Schw. Schr. Nat. Ges. Leipzig 1: 70. 1822. See NOTE 1, p. 110.

COLEOSPORIUM TUSSILAGINIS (Pers.) Lév. in Orbigny Dict. Univ. Hist. Nat. 12: 786. 1849.
Uredo tussilaginis Pers. Syn. Meth. Fung. 218. 1801. Hylander, Jørstad, and Nannfeldt (l.c. p. 8) report that the type specimen here contains telia.
Coleosporium campanulae Lév. ex Kickx: See separate entry.
Coleosporium senecionis Fr. ex Kickx : See separate entry.
Coleosporium sonchi (Strauss) Lév. ex Tul.: See separate entry.

COLEOSPORIUM VERNONIAE Berk. et Curt. in Berk. Grev. 3: 57. 1874.
Coleosporium carneum Jackson Proc. Ind. Acad. Sci. 1917: 312. 1918.

COLEOSPORIUM VIBURNI Arth. No. Amer. Flora 7: 88. 1907.
Coleosporium viburni Arth. Bull. Iowa Agric. Coll. Dept. Bot. 1884: 163. 1884. Telia not described, but present in the type material.

COLEOSPORIUM VIGUIERAE Diet. et Holw. in Holw. Bot. Gaz. 24: 34. 1897.

Cronartium cerebrum Hedgc. et Long: See C. QUERCUUM (Berk.) Miyabe

CRONARTIUM COLEOSPORIOIDES Arth. No. Amer. Flora 7: 123. 1907.
Uredo coleosporioides Diet. et Holw. Erythea 1: 247. 1893. See NOTE 1, p. 110.

There probably is more than one species involved here, but the correct application of names is scarcely possible at present. The aecial stages (Peridermium harknessii J. P. Moore, P. filamentosum Pk., and P. stalactiforme Arth. et Kern) are distinctive but the telial stages, which are probably all on Scrophulariaceae, have never been distinguished. C. coleosporioides Arth. is the only validly published name and it must be recognized. The only telia available to Arthur when he described the telial stage were on a specimen of Castilleja miniata Dougl., collected Aug. 10, 1886 in the mountains of Skamania Co., Wash. by Suksdorf. The specimen must be designated as the type of C. coleosporioides but the appropriate aecial stage is pure guesswork since both P. harknessii and P. stalactiforme occur in the area. It may be only coincidence that the type of P. stalactiforme was collected in the Chiquash Mts., Skamania Co., Wash., also by Suksdorf. Telial state names proposed for the three suggested segregates as listed hereafter are all *nomina nuda*, the telia not having been actually described.

Cronartium filamentosum Hedgc. Phytopath. 2: 177. 1912. Based on Peridermium filamentosum Pk.
Cronartium harknessii Meinecke Phytopath. 10: 282. 1920. Based on Peridermium harknessii J.. P. Moore
Cronartium stalactiforme Arth. et Kern Bull. Torr. Bot. Club 49: 191. 1922. Based on Peridermium stalactiforme Arth. et Kern

CRONARTIUM COMANDRAE Pk. Bot. Gaz. 4: 128. 1879.

CRONARTIUM COMPTONIAE Arth. Bull. Torr. Bot. Club 33: 29. 1906.

CRONARTIUM CONIGENUM Hedgc. et Hunt Phytopath. 12: 120. 1922.
Caeoma conigenum Pat. Jour. de Bot. 10: 386-388. 1896. See NOTE 1, p. 110.
See also Cronartium quercuum (Berk.) Miyabe

CRONARTIUM FLACCIDUM (Alb. et Schw.) Wint. Hedwigia 19: 55. 1880.
Sphaeria flaccida Alb. et Schw. Consp. Fung. Nisk., p. 31. 1805. The type contains telia according to Hylander, Jørstad, and Nannfeldt (loc. cit. p. 12).

CRONARTIUM FUSIFORME Hedgc. et Hunt ex Cumm. Mycologia 48: 603. 1956.
Peridermium fusiforme Arth. et Kern Bull. Torr. Bot. Club 33: 421. 1906. See NOTE 1, p. 110.
Cronartium fusiforme Hedgc. et Hunt Phytopath. 8: 316. 1918. *Nomen nudum.*
See also C. quercuum (Berk.) Miyabe

CRONARTIUM OCCIDENTALE Hedgc., Bethel, et Hunt Phytopath. 14: 413. 1918.

CRONARTIUM QUERCUUM (Berk.) Miyabe ex Shirai Bot. Mag. Tokyo 13: 74. 1899.
Cronartium asclepiadeum quercium Berk. Grev. 3: 59. 1874.
Cronartium quercus Schroeter Michelia 2: 308. 1881. This name often used for the species is based on the uredial state, hence is not valid.

Arthur (Manual Rusts U. S. and Canada, p. 25. 1934.) included C. cerebrum, C. fusiforme, and C. strobilinum in his concept of Cronartium quercuum. C. cerebrum has not been validly published. The other three are now generally recognized as distinct species and are so set up here.

CRONARTIUM RIBICOLA J. C. Fischer ex Rabenhorst Fungi Europaei No. 1595; Hedwigia 11: 182. 1872.

This type bears telia and the description reads, in part: " . . . , die Reihen-Sporen die Fruchtträger farblos." We interpret this as being a description of the telia. Hylander, Jørstad and Nannfeldt (loc. cit. p. 13) accept the J. C. Fischer name.

CRONARTIUM STROBILINUM Hedgc. et Hahn Phytopath. 12: 113. 1922.
Caeoma strobilina Arth. Bull. Torr. Bot. Club 33: 519-520. 1906.
See NOTE 1, p. 110.
See also Cronartium quercuum (Berk.) Miyabe

Cronartium wilsoniana Arth. et J. R. Johnston: See CROSSOPSORA CAUCENSIS (Mayor) Kern, Thurst., et Whet.

CROSSOPSORA CAUCENSIS (Mayor) Kern, Thurst., et Whet. Mycologia 25: 456. 1933.
Uredo caucensis Mayor Mem. Soc. Neuch. Sci. Nat. 5: 587. 1913.
Cronartium wilsoniana Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 114. 1918.
Crossopsora wilsoniana Arth. No. Amer. Flora 7: 696. 1925.

Kern, Thurston, and Whetzel (loc. cit.) report the presence of telia in the type specimen of Uredo caucensis. They do not offer a formal description, but since they cite that of Arthur and Johnston (loc. cit.), the transfer is valid.

**CROSSOPSORA MATELEAE Dale Commonwealth Myc. Inst. Mycol. Papers 59: 4. 1955.
On Fischeria sp., Macroscepsis sp., Matelea viridiflora (G. F. W. Mey.) Woodson: Guatemala, Grenada, St. Vincent, Tobago.

CROSSOPSORA NOTATA (Arth. et J. R. Johnston) Arth. No. Amer. Flora 7: 695. 1925.
Uredo notata Arth. Mycologia 9: 89. 1917. See NOTE 1, p. 110.
Cronartium notatum Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 114. 1918.

**CROSSOPSORA STEVENSII Syd. Mycologia 17: 255. 1925.
On Mandevilla subsagittata (R. et P.) Woodson: Guatemala.

Crossopsora wilsoniana (Arth. et J. R. Johnston) Arth.: See CROSSOPSORA CAUCENSIS (Mayor) Kern, Thurst., et Whet.

Ctenoderma cristatum (Speg.) Syd.: See SKIERKA CRISTATA Mains

CUMMINSIELLA MIRABILISSIMA (Pk.) Nannf. in Lundell et Nannf. Fungi Exs. Suec. No. 1507 a. 1947.
Uromyces sanguinea Pk. Bot. Gaz. 4: 128. 1879. Based on uredia.
Puccinia mirabilissima Pk. Bot. Gaz. 6: 226. 1881.
Uropyxis sanguinea Arth. No. Amer. Flora 7: 155. 1907.
Cumminsiella sanguinea Arth. Bull. Torr. Bot. Club 60: 475. 1933.

Cumminsiella sanguinea (Pk.) Arth.: See C. MIRABILISSIMA (Pk.) Nannf.

**CUMMINSIELLA STANDLEYANA Cumm. Bull. Torr. Bot. Club 67: 607. 1940.
On Berberis fascicularis DC. (= Mahonia pinnata (Lag.) Fedde?): Guatemala.

CUMMINSIELLA TEXANA (Holw. et Long) Arth. Bull. Torr. Bot. Club 60: 475. 1933.
Uropyxis texana Arth. No. Amer. Flora 7: 155. 1907.
Aecidium butlerianum Rosen et Arth. Phytopath. 9: 572. 1919.

CUMMINSIELLA WOOTONIANA (Arth.) Arth. Bull. Torr. Bot. Club 60: 475. 1933.
Uropyxis wootoniana Arth. Bull. Torr. Bot. Club 42: 585. 1915.

Cystingophora hieronymi (Speg.) Arth.: See RAVENELIA HIERONYMI Speg.

**CYSTOMYCES COSTARICENSIS Syd. Ann. Mycol. 24: 290. 1926.
On Leguminosae indet. : Costa Rica.

Dasyspora foveolata (Schw.) Berk. et Curt. : See D. GREGARIA (Kunze ex Weigelt) P. Henn.

DASYPORA GREGARIA (Kunze) P. Henn. Hedwigia 35: 231. 1896.
Puccinia gregaria Kunze in Weigelt Fungi Surinam. 1827.
Dasyspora foveolata Berk. et Curt. Jour. Acad. Nat. Sci. Phil. II 2: 281. 1853. Cites Aecidium foveolatum Schw. (Mss.) as a synomym.

Dendroecia farlowiana (Diet.) Arth. : See RAVENELIA FARLOWIANA Diet.

Dendroecia opaca (Diet.) Arth. : See RAVENELIA OPACA Diet.

Desmella obovata Arth. : See UREDO OBOVATA (Arth.) Cumm.

*DESMELLA SUPERFICIALIS Syd. Ann. Mycol. 16: 242. 1918.
Caeoma superficialis Speg. Anal. Soc. Cien. Argent. 17: 96. 1884. See NOTE 1, p. 110.
On Nephrolepis exaltata (L.) Schott: Florida.

DIABOLE CUBENSIS (Arth. et J. R. Johnston) Arth. Bull. Torr. Bot. Club 49: 194. 1922.
Uromycladium cubense Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 119. 1918.

Dicaeoma: See PUCCINIA

DICHEIRINIA BINATA (Berk.) Arth. No. Amer. Flora 7: 147. 1907.

DICHEIRINIA ORMOSIAE (Arth.) Cumm. Mycologia 27: 155. 1935.
Puccinia ormosiae Arth. Mycologia 9: 78. 1917.

Discospora effusa (Pk.) Arth. : See PILEOLARIA EFFUSA Pk.

ENDOPHYLLOIDES PORTORICENSIS Whet. et Olive in Olive et Whet. Amer. Jour. Bot. 4: 50. 1917.

ENDOPHYLLUM CIRCUMSCRIPTUM (Schw.) Whet. et Olive in Olive et Whet. Amer. Jour. Bot. 4: 49. 1917.
Aecidium circumscriptum Schw. ex Berk. et Curt. Jour. Acad. Phil. II. 2: 283. 1853.

ENDOPHYLLUM DECOLORATUM (Schw.) Whet. et Olive in Olive et Whet. Amer. Jour. Bot. 4: 49. 1917.
Aecidium decoloratum Schw. ex Berk. et Curt. Jour. Acad. Phil. II. 2: 283. 1853.

*ENDOPHYLLUM LACUS-REGIS Savile et Parmelee Mycologia 48: 577. 1956.
On Claytonia caroliniana Michx. : Ontario

ENDOPHYLLUM SEMPERVIVI (Alb. et Schw.) dBy Ann. Sci. Nat. IV. 20: 86. 1863.

ENDOPHYLLUM STACHYTARPHETAE (P. Henn.) Whet. et Olive in Olive et Whet. Jour. Bot. 4: 50. 1917.

ENDOPHYLLUM TUBERCULATUM (Ell. et Kell.) Arth. et Fromme Bull. Torr. Bot. Club 42: 58. 1915.

Frommea duchesneae Arth. : See F. OBTUSA DUCHESNEAE (Arth.) Arth.

**FROMMEA MEXICANA Mains Bull. Torr. Bot. Club 66: 618. 1939.
On Fragaria mexicana Cham. et Schlecht. : Mexico.

FROMMEA OBTUSA (Strauss) Arth. Bull. Torr. Bot. Club 44: 503. 1917.
Uredo obtusa Strauss Ann. Wett. Ges. 2: 107. 1810. Based on telia.

FROMMEA OBTUSA DUCHESNEAE (Arth.) Arth. Manual Rusts U. S. and Canada, p. 93. 1934.
Frommea duchesneae Arth. No. Amer. Flora 7: 185. 1912.

Galloway pinicola Arth. : See COLEOSPORIUM PINICOLA (Arth.) Arth.

Gymnoconia interstititialis Lagh. : See G. PECKIANA (Howe) Trott.

GYMNOCONIA PECKIANA (Howe) Trott. Fl. Ital. Crypt. I (Uredinales), p. 338. 1910.
Gymnoconia interstitialis Lagh. Tromsø Mus. Aarsh. 16: 140. 1894.
Caeoma interstitiale Schlecht. Horae Phys. Berol. 96. 1820. See NOTE 1, p. 110.

Gymnosporangium aurantiacum Chev. : See G. CORNUTUM Arth.

GYMNOSPORANGIUM BERMUDIANUM Earle in Seymour and Earle, Economic Fungi No. 249. 1892.
Aecidium bermudianum Farl. Bot. Gaz. 12: 206. 1887. See NOTE 1, p. 110.

GYMNOSPORANGIUM BETHELII Kern Bull. Torr. Bot. Club 34: 459. 1907.

GYMNOSPORANGIUM BISEPTATUM Ell. Bull. Torr. Bot. Club 5: 46. 1874.
Caeoma (Roestelia) botryapites Schw. Trans. Amer. Phil. Soc. II. 4: 294. 1832.
Gymnosporangium botryapites Kern Bull. Torr. Bot. Club 35: 506. 1908.

Gymnosporangium blasdaleanum (Diet. et Holw.) Kern: See G. LIBOCEDRI (P. Henn.) Kern

Gymnosporangium botryapites (Schw.) Kern: See G. BISEPTATUM Ell.

Gymnosporangium clavariaeforme (Jacq.) DC. : See G. CLAVARIIFORME (Pers.) DC.

GYMNOSPORANGIUM CLAVARIIFORME (Pers.) DC. Fl. Fr. 2: 217. 1805.
Tremella clavariaeformis Pers. Syn. Meth. Fungi., p. 629. 1801.
A correction is made in the spelling of the specific epithet and the prestarting point author (Jacquin) is omitted.

GYMNOSPORANGIUM CLAVIPES (Cke. et Pk.) Cke. et Pk. in Pk. Ann. Rept. N. Y. State Mus. 25: 89. 1873.
Caeoma (Peridermium) germinale Schw. Trans. Amer. Phil. Soc. II. 4: 294. 1832. See NOTE 1, p. 110.
Podisoma gymnosporangium clavipes Cke. et Pk. in Cke. Jour. Quek. Club 2: 267. 1871.
Gymnosporangium germinale Kern Bull. Torr. Bot. Club 35: 506. 1908.

GYMNOSPORANGIUM CORNICULANS Kern in Arth. Mycologia 2: 236. 1910.

GYMNOSPORANGIUM CORNUTUM Arth. ex Kern Bull. N.Y. Bot. Garden 7: 444-445. 1911.
Gymnosporangium cornutum Arth. Mycologia 1: 240. 1909. Telia not described.
Aecidium cornutum Pers. Syn. Meth. Fung., p. 205. 1801.
Gymnosporangium aurantiacum Chev. Fl. Paris 1: 424. 1826.
Hylander, Jørstad, and Nannfeldt (loc. cit. p. 15) consider G. aurantiacum

Chev., a nomen ambiguum, since it may apply to either G. cornutum Arth. or to G. tremelloides Hartig.

GYMNOSPORANGIUM CUPRESSI Long et Goodding in Long Bot. Gaz. 72: 39. 1921.
The aecial stage occurs on Amelanchier (Long and Goodding Mycologia 32: 490. 1940).

GYMNOSPORANGIUM DAVISII Kern Bull. Torr. Bot. Club 35: 507. 1908.

GYMNOSPORANGIUM EFFUSUM Kern Bull. N. Y. Bot. Garden 7: 459. 1911.

GYMNOSPORANGIUM ELLISII (Berk.) Ell. No. Amer. Fungi No. 271. 1879.
Podisoma ellisii Berk. Grev. 3: 56. 1874.
Caeoma (Aecidium) myricatum Schw. Trans. Amer. Phil. Soc. II. 4: 294. 1832. See NOTE 1, p. 110.
Gymnosporangium myricatum Fromme Mycologia 6: 229. 1914.
This species is usually cited as G. ellisii (Berk.) Farl. in Ell. No. Amer. Fungi No. 271. 1879. However, the label of this specimen bears no reference to Farlow, reading "Gymnosporangium (Podisoma) ellisii, Berk." This would indicate that Ellis was making the new combination. It may be noted as confirming this opinion, that the species is cited in the same manner in the two indexes to early centuries of North American Fungi. (Alphabetical Index, Centuries I-X, Ellis, No. Amer. Fungi, p. 3, W. C. Stevenson, Jr. and Alphabetical Index, Centuries I-XV, p. 6, B. M. Everhart.). Farlow (The Gymnosporangia or Cedar-apples of the U. S., p. 11, 1880) cites the species as Gymnosporangium ellisii (Berk.). He was apparently indicating a new combination, but such a combination had been made a year earlier and as far as the record goes, by Ellis..

GYMNOSPORANGIUM EXIGUUM Kern Bull. Torr. Bot. Club 35: 508. 1908.

GYMNOSPORANGIUM EXTERUM Arth. et Kern in Arth. Mycologia 1: 254. 1909.

GYMNOSPORANGIUM FLORIFORME Thaxt. in Kern Bull. Torr. Bot. Club 35: 503. 1908.
Gymnosporangium flaviformis (Atk.) Earle Contrib. U. S. Nat. Herb. 6: 186. 1901. Nomen nudum.

GYMNOSPORANGIUM FRATERNUM Kern Bull. N. Y. Bot. Garden 7: 439. 1911.
Roestelia transformans Ell. in Pk. Bull. Torr. Bot. Club 5: 3. 1874. See NOTE 1, p. 110.
Gymnosporangium transformans Kern Bull. N. Y. Bot. Garden 7: 463. 1911.

Gymnosporangium germinale (Schw.) Kern: See G. CLAVIPES (Cke et Pk.) Cke. et Pk.

GYMNOSPORANGIUM GLOBOSUM Farl. The Gymnosporangia or Cedar-apples of the U. S., p. 34. 1880.

Gymnosporangium gracilens (Pk.) Kern et Bethel: See G. SPECIOSUM Pk.

Gymnosporangium guatemalianum Crowell: See ROESTELIA GUATEMALIANA (Crowell) Cumm.

GYMNOSPORANGIUM HARAEANUM Syd. Ann. Mycol. 10: 405. 1912.
Gymnosporangium koreaense Jacks. Jour. Agr. Res. 5: 1006. 1916.

GYMNOSPORANGIUM HARKNESSIANUM Kern ex Arth. No. Amer. Flora 7: 737. 1926.
Roestelia harknessianum Ell. et Ev. ex Kern Bull. Torr. Bot. Club 34: 462. 1907. See NOTE 1, p. 110.
Gymnosporangium harknessianum Kern Bull. N. Y. Bot. Garden 7: 441. 1911. Telia not described.

GYMNOSPORANGIUM HYALINUM Kern ex Cumm. Mycologia 48: 603. 1956.
Roestelia hyalina Cke. Bull. Soc. Bot. France 24: 315. 1877.
See NOTE 1, p. 110.
Gymnosporangium hyalinum Kern Bull. N. Y. Bot. Garden 7: 470. 1911. Based on aecia.
Gymnosporangum hyalinum Kern et West Mycologia 39: 123. 1947. Telia first described, but without Latin diagnosis.
On Chamaecyparis thyoides (L.) B. S. P.: Florida, South Carolina.

GYMNOSPORANGIUM INCONSPICUUM Kern Bull. Torr. Bot. Club 32: 461. 1907.
Roestelia photiniae P. Henn. Hedwigia 33: 231. 1894. See NOTE 1, p. 110.
Gymnosporangium photiniae Kern Bull. N. Y. Bot. Garden 7: 443. 1911.

Gymnosporangium juniperinum L. ex Mart.: See G. TREMELLOIDES Hartig

GYMNOSPORANGIUM JUNIPERI-VIRGINIANAE Schw. Schr. Nat. Ges. Leipzig 1: 74. 1822.

GYMNOSPORANGIUM JUVENESCENS Kern Bull. N.Y. Bot. Gard. 7: 448. 1911.
According to Prince (Farlowia 2: 481. 1946.) this species is synonymous with G. nidus-avis Thaxt.

GYMNOSPRANGIUM KERNIANUM Bethel Mycologia 3: 157. 1911.

Gymnosporangium koreaense Jacks.: See G. HARAEANUM Syd.

GYMNOSPORANGIUM LIBOCEDRI (P. Henn.) Kern Bull. Torr. Bot. Club 35: 509. 1908.
Aecidium blasdaleanum Diet. et Holw. Erythea 3: 77. 1895.
See NOTE 1, p. 110.
Phragmidium libocedri P. Henn. Hedwigia 37: 271. 1898.
Gymnosporangium blasdaleanum Kern Bull. N.Y. Bot. Garden 7: 437. 1911.

**GYMNOSPORANGIUM MERIDISSIMUM Crowell Canad. Jour. Res. C, 16: 11. 1942.
On Cupressus benthami Endl.: Guatemala.

GYMNOSPORANGIUM MULTIPORUM Kern Mycologia 1: 210. 1909.

Gymnosporangium myricatum (Schw.) Fromme: See G. ELLISII (Berk.) Ell.

GYMNOSPORANGIUM NELSONI Arth. Bull. Torr. Bot. Club 28: 665. 1901.

GYMNOSPORANGIUM NIDUS-AVIS Thaxt. Conn. Agric. Exp. Sta. Bull. 107: 3. 1891.
G. juvenescens Kern is synonymous, according to Prince (Farlowia 2: 481. 1946).

GYMNOSPORANGIUM NOOTKATENSE Arth. Amer. Jour. Bot. 3: 44. 1916.
Uredo nootkatensis Trel. Harr. Alaska Exp. Crypt., p. 36. 1904.
See NOTE 1, p. 110.
Gymnosporangium sorbi Kern Bull. N.Y. Bot. Garden 7: 438. 1911. Telia not described.
Gymnotelium nootkatense Syd. Ann. Mycol. 19: 170. 1921.

Gymnosporangium photiniae Kern: See G. JAPONICUM Syd.

Gymnosporangium sorbi Kern: See G. NOOTKATENSE Arth.

GYMNOSPORANGIUM SPECIOSUM Pk. Bot. Gaz. 4: 217. 1879.
Aecidium gracilens Pk. Bot. Gaz. 4: 128. 1879. See NOTE 1, p. 110.
Gymnosporangium gracilens Kern et Bethel in Kern Bull. N. Y. Bot. Garden 7: 455. 1911.

GYMNOSPORANGIUM TRACHYSORUM Kern in Arth. Mycologia 2: 237-238. 1910.

Gymnosporangium transformans (Ell.) Kern: See G. FRATERNUM Kern

GYMNOSPORANGIUM TREMELLOIDES Hartig Lehrb. Baumkrankh., p. 55. 1882.
Gymnosporangium juniperinum Mart. Fl. Crypt. Erlang., p. 333. 1817.
Hylander, Jørstad, and Nannfeldt (loc. cit. p. 15), consider _G. juniperinum_ a _nomen ambiguum_, since it may apply to either _G. cornutum_ Arth. or _G. tremelloides_ Hartig.

GYMNOSPORANGIUM TUBULATUM Kern ex Arth. No. Amer. Flora 7: 738. 1926.
Gymnosporangium tubulatum Kern Bull. N. Y. Bot. Garden 7: 451. 1911. Telia not described.

*GYMNOSPORANGIUM VAUQUELINIAE Long et Goodding Mycologia 31: 671. 1939.
On _Vauquelinia californica_ Sarg. and _Juniperus monosperma_ (Engelm.) Sarg. in Arizona.

Gymnotelium nootkatense Syd.: See GYMNOSPORANGIUM NOOTKATENSE Arth.

HAPLOPYXIS CROTALARIAE (Arth.) Syd. Ann. Mycol. 17: 105. 1919.

HYALOPSORA ASPIDIOTUS (Magn.) Magn. Ber. Deutsch. Bot. Ges. 19: 582. 1901.
Uredo aspidiotus Pk. Rept. N. Y. State Mus. 24: 88. 1872. See NOTE 1, p. 110.
Melampsorella aspidiotus Magn. Ber. Deutsch. Bot. Ges. 13: 288. 1895.

HYALOPSORA CHEILANTHIS Arth. Manual Rusts U. S. and Canada, p. 11. 1934.
Caeoma cheilanthis Pk. Bull. Torr. Bot. Club 10: 62. 1883. See NOTE 1, p. 110.

Hyalopsora laeviuscula (Diet. et Holw.) Arth.: See MILESIA LAEVIUSCULA (Diet. et Holw.) Faull

Hyalopsora obovata (Arth.) Cumm.: See UREDO OBOVATA. (Arth.) Cumm.

HYALOPSORA POLYPODII (Diet.) Magn. Ber. Deutsch. Bot. Ges. 19: 582. 1901.
Uredo linearis var. polypodii Pers. Syn. Fung., p. 217. 1801. See NOTE 1, p. 110.
Uredo polypodii DC. Fl. Fr. 6: 81. 1815. See NOTE 1, p. 110.
Pucciniastrum polypodii Diet. Hedwigia 38 (Beibl.): 260. 1899.

Klebahnia: See UROMYCES

KUEHNEOLA ARTHURI (Syd.) Jacks. Mycologia 23: 106. 1931.
Spirechina arthuri (Syd.) Arth. No. Amer. Flora 7: 183. 1912.

**KUEHNEOLA GUATEMALENSIS Cumm. Bull. Torr. Bot. Club 70: 71. 1943.
On _Rubus tuerckheimii_ Rydb.: Guatemala.

KUEHNEOLA LOESENERIANA (Arth.) Jacks. et Holw. in Jacks. Mycologia 23: 105. 1931.
Spirechina loeseneriana Arth. Mycologia 13: 30. 1907. Telia first described.

KUEHNEOLA MALVICOLA Arth. No. Amer. Flora 7: 187. 1912.
Uredo malvicola Speg. Anal. Soc. Cien. Argent. 17: 124. 1884.
See NOTE 1, p. 110.

KUEHNEOLA UREDINIS (Lk.) Arth. Rés. Sci. Congr. Bot. Vienne, p. 342. 1906.

KUNKELIA NITENS (Schw.) Arth. Bot. Gaz. 63: 504. 1917.

LIPOCYSTIS CAESALPINIAE (Arth.) Cumm. Bull. Torr. Bot. Club 64: 39. 1937.
Ravenelia caesalpiniae Arth. Bull. Torr. Bot. Club 31: 5. 1904.

MAINSIA EPIPHYLLA (Arth.) Jacks. Mycologia 23: 112. 1931.
Spirechina epiphylla Arth. No. Amer. Flora 7: 184. 1912.

**MAINSIA HOLWAYI Jacks. Mycologia 23: 109. 1931.
On Rubus adenotrichus Schl., R. irasuensis Liebm.: Guatemala.

MAINSIA PITTIERIANA (P. Henn.) Jacks. Mycologia 23: 110. 1931.
Spirechina pittieriana (P. Henn.) Arth. No. Amer. Flora 7: 183. 1912.

MAINSIA RUBI (Diet. et Holw.) Jacks. Mycologia 23: 110. 1931.
Spirechina rubi (Diet. et Holw.) Arth. No. Amer. Flora 7: 184. 1912.

**MAINSIA STANDLEYI Cumm. Bull. Torr. Bot. Club 70: 71. 1943.
On Rubus irasuensis Liebm.: Guatemala.

Maravalia ingae Syd.: See CHACONIA INGAE (Syd.) Cumm.

MARAVALIA PRESSA (Arth. et Holw.) Mains Bull. Torr. Bot. Club 66: 177. 1939.
Uromyces pressus Arth. et Holw. Mycologia 10: 125. 1918.

**MARAVALIA PURA (Syd.) Mains Bull. Torr. Bot. Club 66: 178. 1939.
On Vernonia patens H. B. K.: Costa Rica.

Maravalia utriculata Syd.: See CHACONIA INGAE (Syd.) Cumm.

MELAMPSORA ABIETIS-CANADENSIS C. A. Ludwig ex Arth. No. Amer. Flora 7: 664. 1924.
Caeoma abietis-canadensis Farl. Proc. Amer. Acad. 20: 323. 1885. See NOTE 1, p. 110.
Melampsora abietis-canadensis C. A. Ludwig Phytopath. 5: 279. 1915. Nomen nudum.
Melampsora populi-tsugae J. J. Davis Trans. Wis. Acad. 19: 676. 1919. Nomen nudum.

MELAMPSORA ABIETI-CAPRAEARUM Tub. Centralbl. Bakt. II, 9: 241. 1902.
See also M. epitea Thuem.

Melampsora aecidioides (DC.) Schroet.: See M. POPULNEA (Pers.) Karst.

MELAMPSORA ALBERTENSIS Arth. Bull. Torr. Bot. Club 33: 517. 1906.
The aecia of this species occur on Pseudotsuga, but the name Caeoma occidentale Arth. does not apply. See Melampsora occidentalis Jacks.

MELAMPSORA ARCTICA Rostr. Medd. Grønland 3: 535. 1888. See also M. epitea Thuem.

Melampsora bigelowii Thuem.: See M. PARADOXA Diet. et Holw.

Melampsora confluens Jacks.: See M. RIBESII-PURPUREAE Kleb.

MELAMPSORA EPITEA Thuem. Mitth. Forstl. Versuchsw. Oesterr. 2: 38 et 40. 1879.

Uredo epitea Kunze et Schm. Mycol. Hefte 1, p. 68. 1817. See NOTE 1, p. 110.

According to Hylander, Jørstad, and Nannfeldt (loc. cit., p. 19) the following are forms only of the above species, since they cannot be distinguished morphologically:

Melampsora abieti-capraearum Tub.
Melampsora arctica Rostr.
Melampsora ribesii-purpureae Kleb.

MELAMPSORA EUPHORBIAE (Schub.) Cast. Obs. Myc. 2: 18. 1843.

MELAMPSORA EUPHORBIAE-GERARDIANAE W. Muell. Centralbbl. Bakt. II 548. 1907.

MELAMPSORA FARLOWII (Arth.) J. J. Davis Trans. Wis. Acad. Sci. 18: 107. 1915.
Necium farlowii Arth. No. Amer. Flora 7: 114. 1907.

Melampsora humboldtiana Speg.: See M. ABIETI-CAPRAEARUM Tub.

*MELAMPSORA HYPERICORUM Wint. in Rabh. Krypt.-Fl. 2 Auf., I, 1: 241. 1884.
Uredo hypericorum DC. Fl. Fr. 6: 81. 1815. See NOTE 1, p. 110.
Mesopsora hypericorum Diet. Ann. Mycol. 20: 30. 1922.
On _Hypericum scouleri_ Hook.: Montana.

MELAMPSORA LINI (Ehrenb.) Lév. Ann. Sci. Nat. III. 8: 376. 1847.
Uredo miniata lini Pers. Syn. Meth. Fung., p. 216. 1801. See NOTE 1, p. 110.
Xyloma lini Ehrenb. Sylvae Myc. Berol., p. 27. 1818.

MELAMPSORA MEDUSAE Thuem. Bull. Torr. Bot. Club 6: 216. 1878.

MELAMPSORA MONTICOLA Mains Phytopath. 7: 103. 1917.

MELAMPSORA OCCIDENTALIS Jacks. Phytopath. 7: 354. 1917.
Caeoma occidentalis Arth. Bull. Torr. Bot. Club 34: 591. 1907.
Ziller (Can. Jour. Bot. 33: 180-181. 1955) has pointed out that this aecial name belongs with _M. occidentalis_ rather than with _M. albertensis_.

MELAMPSORA PARADOXA Diet. et Holw. in Diet. Hedwigia 40 (Beibl.): 32. 1901.
Melampsora bigelowii Thuem. Mitth. Forstl. Vers. Oest. 2: 37. 1879.
Based on uredia only.

Melampsora piscariae Jacks.: See UREDO PISCARIAE (Jacks.) Cumm.

MELAMPSORA POPULNEA (Pers.) Karst. Bidr. Känned. Finl. Nat. Folk 31: 53. 1879.
Sclerotium populneum Pers. Syn. Meth. Fung., p. 125. 1801.
Melampsora aecidioides Schroet. in Cohn Krypt.-Fl. Schles. III 1: 362. 1887.
This name is superseded as above on the authority of Hylander, Jørstad, and Nannfeldt (loc. cit., p. 24).

MELAMPSORA RIBESII-PURPUREAE Kleb. Pringsh. Jahrb. Wiss. Bot. 35: 667. 1901.
See also _M. epitea_ Thuem.

MELAMPSORELLA CARYOPHYLLACEARUM Schroet. Hedwigia 13: 85. 1874.
Melampsorella cerastii Wint. Hedwigia 19: 56. 1880. Telia not described.
Melampsorella cerastii Schroet. in Cohn Krypt.-Fl. Schles. III, 1: 366. 1887. A later homonym.
Melampsorella elatina Arth. No. Amer. Flora 7: 111. 1907.

For the species on _Picea_ spp. sometimes included here see _Peridermium coloradense_ (Diet.) Arth.

Melampsorella cerastii (Pers.) Schroet. : See M. CARYOPHYLLACEARUM Schroet.

Melampsorella elatina Arth. : See M. CARYOPHYLLACEARUM Schroet.

Melampsoridium alni Auct. non Diet. : See M. HIRATSUKANUM Ito

MELAMPSORIDIUM BETULINUM (Fr.) Kleb. Zeitschr. Pflanzenkr. 9: 21. 1899.
Uredo populina betulina Pers. Syn. Meth. Fung., p. 219. 1801. See NOTE 1, p. 110.
Uredo betulae Schum. Enum. Pl. Saell. 2: 228. 1803. See NOTE 1, p. 110.
Sclerotium (Xyloma) betulinum Fr. Syst. Myc. 2: 262. 1822. Telia present?

MELAMPSORIDIUM CARPINI (Fckl.) Diet. in Engler & Prantl Nat. Pfl. I 1**: 551. 1900.
Caeoma carpini Nees Syst. Pilze, p. 16. 1816. See NOTE 1, p. 110.
Melampsora carpini Fckl. Jahrb. Nassau Ver. Nat. 23-24: 44. 1870.

MELAMPSORIDIUM HIRATSUKANUM Ito ex Hirat. f. Jour. Fac. Agric. Hokkaido Imper. Univ. 21: 10. 1927.
Melampsoridium alni Auct. non Dietel
North American material should be referred to the Ito species, rather than to the European species of Dietel as has been the practice heretofore.

Melampsoropsis: See CHRYSOMYXA

Mesopsora hypericorum (Wint.) Diet. : See MELAMPSORA HYPERICORUM Wint.

Micropuccinia: See PUCCINIA

MILESIA
In considering the problem of Milesia vs. Milesina it has been decided that the former more nearly conforms to the spirit of the present code. A discussion of the problem is found in Faull's Monograph (Contrib. Arnold Arbor. 2: 5-11. 1932).

MILESIA ACUTA Faull Jour. Arnold Arb. 37: 314-315. 1956.
On Woodwardia fimbriata Sm. : California. Based on uredia only.

MILESIA AUSTRALIS Arth. ex Faull Contrib. Arnold Arbor. 2: 41-42. 1932.
Milesia australis Arth. Bull. Torr. Bot. Club 51: 53. 1924. Telia not described.
Faull (loc. cit. p. 43) recognizes forma typica and f. irregularis.

Milesia consimilis Arth. : See UREDO CONSIMILIS (Arth.) Cumm.

Milesia columbiensis (Diet.) Arth. Puerto Rican material referred here in error. See M. insularis Faull

MILESIA DARKERI Faull Contrib. Arnold Arbor. 2: 46. 1932.

MILESIA DILATATA Faull Contrib. Arnold Arbor. 2: 49. 1932.

MILESIA FRUCTUOSA Faull Contrib. Arnold Arbor. 2: 51-52. 1932.
Milesia intermedia Faull Contrib. Arnold Arbor. 2: 64-66. 1932.

MILESIA INSULARIS Faull Contrib. Arnold Arbor. 2: 76. 1932.
Telia are unknown for this species. Its transfer to Uredo was overlooked (Mycologia 48: 601-608. 1956.)

Milesia intermedia Faull: See M. FRUCTUOSA Faull

Milesia kriegeriana (Magn.) Arth. A nomen confusum. See M. FRUCTUOSA Faull and M. MARGINALIS Faull et W. R. Watson

MILESIA LAEVIUSCULA (Diet. et Holw.) Faull Contrib. Arnold Arbor. 2: 95. 1932.
Uredo laeviuscula Diet. et Holw. Erythea 2: 127. 1894. The type has telia.
Hyalopsora laeviuscula Arth. No. Amer. Flora 7: 113. 1907.

MILESIA MARGINALIS Faull et W. R. Watson in Faull Contrib. Arnold Arbor. 2: 69-71. 1932.

Milesia polypodophila Faull : See M. PYCNOGRANDIS Arth.

MILESIA POLYSTICHI Wineland ex Faull Contrib. Arnold Arbor. 2: 108-109. 1932.
Milesia polystichi Wineland in Jacks. Mem. Brooklyn Bot. Garden 1: 214. 1918. Telia not described.

MILESIA PYCNOGRANDIS Arth. No. Amer. Flora 7: 685. 1925.
Peridermium pycnogrande Bell Bot. Gaz. 77: 24. 1924. See NOTE 1, p. 110.
Uredinopsis polypodophila Bell Bot. Gaz. 77: 25. 1924. Uredia only described.
Milesia polypodophila Faull Contrib. Arnold Arbor. 2:89-90. 1932.

MILESIA VOGESIACA Faull Contrib. Arnold Arbor. 2: 103-104. 1932.
Milesina vogesiaca Syd. Ann. Mycol. 8: 491. 1910. Uredia only described.

Necium farlowii Arth.: See MELAMPSORA FARLOWII (Arth.) J. J. Davis

Neoravenelia holwayi (Diet.) Long: See RAVENELIA HOLWAYI Diet.

Neoravenelia subtortuosae (Long) Arth.: See RAVENELIA SUBTORTUOSAE Long

Nephlyctis conjuncta (Diet. et Holw.) Arth.: See PROSPODIUM CONJUNCTUM (Diet. et Holw.) Cumm.

Nephlyctis transformans (Ell. et Ev.) Arth.: See PROSPODIUM TRANSFORMANS (Ell. et Ev.) Cumm.

Nigredo: See UROMYCES

NYSSOPSORA CLAVELLOSA (Berk.) Arth. No. Amer. Flora 7: 180. 1912.

NYSSOPSORA ECHINATA (Lév.) Arth. Res. Sci. Congr. Bot. Vienne, p. 342. 1906.

OLIVEA CAPITULIFORMIS Arth. Mycologia 9: 61. 1917.
Uredo capituliformis P. Henn. Hedwigia 34: 97. 1895. See NOTE 1, p. 110.

OLIVEA PETITIAE Arth. Mycologia 9: 62. 1917.

*PERIDERMIUM APPALACHIANUM Hepting et Cumm. Phytopath. 42: 115. 1952.
On Pinus virginiana Mill.: North Carolina, Tennessee, Virginia.

PERIDERMIUM COLORADENSE (Diet.) Arth. et Kern Bull. Torr. Bot. Club 33: 426. 1906.

PERIDERMIUM EPHEDRAE Cke. Indian Forester 3: 95. 1877.

PERIDERMIUM GUATEMALENSE Arth. et Kern Mycologia 6: 121. 1914.

Peridermium ingenuum Arth. : See PUCCINIASTRUM ARCTICUM Tranz.

**PERIDERMIUM MONTEZUMAE Cumm. Bull. Torr. Bot. Club 67: 613. 1940.
On Pinus oocarpa Schiede, P. montezumae Lamb. : Guatemala, Honduras.

Peridermium parksianum Faull: See CHRYSOMYXA PIPERIANA Sacc.

PERIDERMIUM RUGOSUM Jacks. in Arth. No. Amer. Flora 7: 646. 1924.

PERIDERMIUM WEIRII Arth. No. Amer. Flora 7: 645. 1924.

Phakopsora aeschynomenis Arth. : See UREDO AESCHYNOMENIS Arth.

**PHAKOPSORA ANTIGUENSIS Kern et Thurst. ex Cumm. Mycologia 48: 604. 1956.
Uredo antiguensis Cumm. Bull. Torr. Bot. Club 67: 613. 1940. See NOTE 1, p. 110.
Phakopsora antiguensis Kern et Thurst. Mycologia 36: 508. 1944. Latin diagnosis not provided.
On Acalypha guatemalensis Pax. et Hoffm. : Guatemala

PHAKOPSORA BURSERAE (Syd.) Thirum. et Kern Mycologia 41: 287. 1949.
To completely validate this binomial, a Latin diagnosis is necessary.
Physopella burserae Syd. Ann. Mycol. 23: 321. 1925. Telia not reported, but now known to be present on type.

PHAKOPSORA CHERIMOLIAE Cumm. Mycologia 48: 604. 1956.
Uredo cherimoliae Lagh. Bull. Soc. Myc. France 11: 215. 1895. See NOTE 1, p. 110.
Physopella cherimoliae Arth. Rés. Sci. Congr. Bot. Vienne, p. 338. 1906. Based on uredia.
Phakopsora cherimoliae Cumm. Bull. Torr. Bot. Club 68: 467. 1941. Latin diagnosis not provided.

Phakopsora crotonis (Cke.) Arth. : See BUBAKIA CROTONIS (Burr.) Arth.

Phakopsora desmium (Berk. et Br.) Cumm.: See PHAKOPSORA GOSSYPII (Arth.) Hirat. f.

Phakopsora dominicana Kern: See BAEODROMUS DOMINICANA (Kern) Thirum. et Kern

PHAKOPSORA FENESTRALA (Arth.) Arth. Bull. Torr. Bot. Club 44: 508. 1917.
Schroeteriaster fenestrala Arth. Mycologia 8: 24. 1916.

PHAKOPSORA GOSSYPII (Arth.) Hirat. f. Uredin. Studies, p. 266. Oct. 10, 1955.
Aecidium desmium Berk. et Br. Jour. Linn. Soc. Bot. 14: 95. 1873. See NOTE 1, p. 110.
Uredo gossypii Lagh. Jour. Myc. 7: 48. 1891. See NOTE 1, p. 110.
Kuehneola gossypii Arth. No. Amer. Flora 7: 187. 1912.
Cerotelium desmium Arth. No. Amer. Flora 7: 698. 1925.
Phakopsora desmium Cumm. Bull. Torr. Bot. Club 72: 206. 1945.
Phakopsora gossypii Dale Commonwealth Myc. Inst. Myc. Paper 60: 4. Dec. 1955.

PHAKOPSORA JATROPHICOLA Cumm. Mycologia 48: 604. 1956.
Uredo jatrophicola Arth. Mycologia 7: 331. 1915.
Phakopsora jatrophicola Cumm. Bull. Torr. Bot. Club 64: 43. 1937. Latin diagnosis not provided.

Phakopsora mexicana Arth. : See BUBAKIA MEXICANA Arth.

PHAKOPSORA PACHYRHIZAE Syd. Ann. Mycol. 12: 108. 1914.
Phakopsora vignae Arth. Bull. Torr. Bot. Club 44: 509. 1917.

PHAKOPSORA TECTA Jacks. et Holw. in Jacks. Mycologia 18: 148. 1926.
Uredo commelyneae Kalchbr. Grevillea 11: 24. 1882.
Phakopsora commelinae Gäumann Bull. Jard. Bot. Buitenzorg Ser. 3, 5: 4-5. 1922. Based on uredia.

Phakopsora vignae (Bres.) Arth.: See P. PACHYRHIZAE Syd.

Phakopsora vitis (Thuem.) Syd.: See ANGIOPSORA AMPELOPSIDIS (Diet. et Syd.) Thirum. et Kern

*PHAKOPSORA ZIZYPHI-VULGARIS Diet. Ann. Mycol. 8: 469. 1910.
On Zizyphus jujuba Mill., Z. mauritana Lam.: Florida.

PHRAGMIDUM ALASKANUM (Arth.) Syd. Monogr. Ured. 3: 155. 1912.

PHRAGMIDIUM AMERICANUM (Pk.) Diet. Hedwigia 44: 124. 1905.

PHRAGMIDIUM ANDERSONII Shear Bull. Torr. Bot. Club 29: 453. 1902.

*PHRAGMIDIUM ARCTICUM Lagh. ex Liro Bidr. Finl. Nat. Folk 65: 419. 1908.
On Rubus acaulis Michx.: Quebec.

PHRAGMIDIUM BILOCULARE Diet. et Holw. in Diet. Bot. Gaz. 19: 305. 1894.

Phragmidium disciflorum (Tode) James: See P. MUCRONATUM (Pers.) Schlecht.

PHRAGMIDIUM FUSIFORME Schroet. Abh. Schles. Ges. Vaterl. Cult., Nat. Abth. 1869-72: 24. 1870.
Phragmidium rosae-acicularis Liro Bidr. Finl. Nat. Folk 65: 428. 1908.

**PHRAGMIDIUM GUATEMALENSE Cumm. Bull. Torr. Bot. Club 67: 609. 1940.
On Potentilla heterosepala Fritsch: Guatemala.

PHRAGMIDIUM HORKELIAE Garrett Fungi Utah. No. 112. 1907.

PHRAGMIDIUM IVESIAE Syd. Ann. Mycol. 1: 329. 1903.

PHRAGMIDIUM JONESII Diet. Hedwigia 44: 128. 1905.

PHRAGMIDIUM MONTIVAGUM Arth. Torreya 9: 24. 1909.

PHRAGMIDIUM MUCRONATUM (Pers.) Schlecht. Fl. Berol. 2: 156. 1824.
Puccinia mucronata rosae Pers. Syn. Meth. Fung., p. 230. 1801.
Phragmidium disciflorum (Tode) James Contrib. U. S. Nat. Herb. 3: 276. 1895. Based on a pre-starting point name for an imperfect state.

PHRAGMIDIUM OCCIDENTALE Arth. in Greene Pl. Baker. 2: 3. 1901.

PHRAGMIDIUM PECKIANUM Arth. No. Amer. Flora 7: 164. 1912.

PHRAGMIDIUM POTENTILLAE (Pers.) Karst. Bidr. Finl. Nat. Folk 31: 49. 1879.

Phragmidium rosae-acicularis Liro: See P. FUSIFORME Schroet.

PHRAGMIDIUM ROSAE-ARKANSANAE Diet. Hedwigia 44: 333. 1905.

PHRAGMIDIUM ROSAE-CALIFORNICAE Diet. Hedwigia 44: 125. 1905.

PHRAGMIDIUM ROSAE-PIMPINELLIFOLIAE Diet. Hedwigia 44: 339. 1905.
Phragmidium subcorticium Wint. in Rabh. Krypt.-Fl. Ed. 2, I, 1: 228. 1882. (pro parte). Material formerly under this name belongs partly to the above species and partly to P. mucronatum.

PHRAGMIDIUM ROSICOLA (Ell. et Ev.) Arth. Manual Rusts U. S. and Canada, p. 89. 1934.
Uromyces rosicola Ell. et Ev. Amer. Nat. 31: 427. 1897.
Ameris rosicola Arth. Rés. Sci. Congr. Bot. Vienne, p. 342. 1906.

PHRAGMIDIUM RUBI-IDAEI (DC.) Karst. Bidr. Finl. Nat. Folk 31: 52. 1879.

PHRAGMIDIUM RUBI-ODORATI Diet. Hedwigia 44: 120. 1905.

PHRAGMIDIUM SPECIOSUM (Fr.) Cke. Grevillea 3: 171. 1875.

Phragmidium subcorticium Wint.: See P. ROSAE-PIMPINELLIFOLIAE Diet.

*PHRAGMIDIUM TUBERCULATUM J. Muell. Ber. Deutsch. Bot. Ges. 3: 391. 1885.
On Rcsa sp.: Connecticut, Alaska.

PHRAGMIDIUM VIOLACEUM (C. F. Schultz) Wint. Hedwigia 19: 54. 1880.
On Rubus sp.: Mississippi. The record is based on a specimen submitted by the late L. E. Miles. The method of introduction and the possible persistence of the fungus is unknown.

PHRAGMOPYXIS ACUMINATA (Long) Syd. Monogr. Ured. 3: 160. 1915.

*PHRAGMOPYXIS DEGLUBENS (Berk. et Curt.) Diet. in Engler et Prantl. Nat. Pflanzenf. 1 (1**): 70. 1897.
On Benthamantha edwardsii (A. Gray) Kuntze: Arizona.

Physopella aeschynomenis Arth.: See UREDO AESCHYNOMENIS Arth.

Physopella artocarpi (Berk. et Br.) Arth.: See UREDO ARTOCARPI Berk. et Br.

Physopella burserae Syd.: See PHAKOPSORA BURSERAE Thirum. et Kern

Physopella fici (Cast.) Arth.: See CEROTELIUM FICI (Butl.) Arth.

Physopella ficina (Juel) Arth.: See UREDO FICINA Juel

Physopella vitis (Thuem.) Arth.: See ANGIOPSORA AMPELOPSIDIS (Diet. et Syd.) Thirum. et Kern

PILEOLARIA BREVIPES Berk. et Rav. in Berk. Grevillea 3: 58. 1874.
Uromyces toxicodendri Berk. et Rav. in Berk. Grevillea 3: 56. 1874. Uredia only described.
Pileolaria toxicodendri Arth. No. Amer. Flora 7: 147. 1907.

PILEOLARIA EFFUSA Pk. Bot. Gaz. 7: 55. 1882.
Discospora effusa Arth. No. Amer. Flora 7: 149. 1907.

Pileolaria extensa Arth.: See URAECIUM EXTENSUM (Arth.) Cumm.

**PILEOLARIA INCRUSTANS (Arth. et Cumm.) Thirum. et Kern Bull. Torr. Bot. Club 82: 105. 1955.
Atelocauda incrustans Arth. et Cumm. Ann. Mycol. 31: 41. 1933.
On Lonchocarpus sp.: Panama.

Pileolaria mexicana Arth. : See UREDO MEXICANA (Arth.) Cumm.

PILEOLARIA PATZCUARENSIS (Holw.) Arth. No. Amer. Flora 7: 148. 1907.

**PILEOLARIA STANDLEYI Cumm. Bull. Torr. Bot. Club 70: 73. 1943.
On Pistacia mexicana H. B. K. : Guatemala.

Pileolaria toxicodendri (Berk. et Rav.) Arth. : See P. BREVIPES Berk. et Rav.

POLIOMA NIVEA (Holw.) Arth. Jour. Mycol. 13: 29. 1907.
Puccinia nivea Holw. Jour. Mycol. 11: 158. 1905.

**POLIOMA ROBUSTA J. W. Baxter et Cumm. Bull. Torr. Bot. Club 78: 53. 1951.
On Salvia compacta Kuntze: Mexico.

POLIOMA UNILATERALIS (Arth.) J. W. Baxter et Cumm. Bull. Torr. Bot. Club 78: 54. 1951.
Uredo unilateralis Arth. Bull. Torr. Bot. Club 45: 155. 1918.
The type bears telia.
Puccinia unilateralis Cumm. Bull. Torr. Bot. Club 67: 67. 1940.

Poliotelium dolichosporum (Diet. et Holw.) Mains: See UROMYCES DOLICHOSPORUS Diet. et Holw.

PROSPODIUM AEQUINOCTIALE (Holw.) Cumm. Lloydia 3: 22. 1940.
Puccinia aequinoctialis Holw. Ann. Mycol. 3: 22. 1905.

PROSPODIUM AMPHILOPHII (Diet. et Holw.) Arth. Jour. Myc. 13: 31. 1907.

*PROSPODIUM APPENDICULATUM (Wint.) Arth. Jour. Mycol. 13: 31. 1907.
On Tecoma stans (L.) H. B. K. : Florida, Texas.

**PROSPODIUM APPENDICULATUM (Wint.) Arth. var. ABORTIVUM Cumm. Lloydia 3: 36. 1940.
On Tecoma stans (L.) H. B. K. : Jamaica.

PROSPODIUM BAHAMENSE Arth. Bull. Torr. Bot. Club 34: 587. 1908.

PROSPODIUM CONJUNCTUM (Diet. et Holw.) Cumm. Lloydia 3: 61. 1940.
Nephlyctis conjuncta (Diet. et Holw.) Arth. No. Amer. Flora 7: 163. 1912.

**PROSPODIUM CONSTRICTUM Cumm. Lloydia 3: 29. 1940.
On Anemopaegma belizeanum Blake: British Honduras.

**PROSPODIUM COURALIAE Syd. Ann. Mycol. 23: 320. 1925.
On Tabebuia pentaphylla (L.) Hemsl. : British Honduras, Costa Rica.

**PROSPODIUM CYDISTAE Mains Carnegie Inst. Wash. Publ. 261: 98. 1935.
On Cydista sp. : Guatemala.

PROSPODIUM DEPALLENS (Arth. et Holw.) Cumm. Lloydia 3: 62. 1940.
Puccinia depallens Arth. et Holw. in Arth. Mycologia 10: 139. 1918.

PROSPODIUM ELATIPES (Arth. et Holw.) Cumm. Lloydia 3: 21. 1940.
Puccinia elatipes Arth. et Holw. in Arth. Mycologia 10: 133. 1918.

*PROSPODIUM LIPPIAE (Speg.) Arth. No. Amer. Flora 7: 161. 1918.
On Lippia ligustrina (Lag.) Britt. : Arizona.

PROSPODIUM PERMAGNUM (Arth. et Holw.) Cumm. Lloydia 3: 62. 1940.
Puccinia permagna Arth. et Holw. in Arth. Mycologia 10: 134. 1918.

**PROSPODIUM PITHECOCTENII (Paz.) Cumm. Lloydia 3: 25. 1940.
On Pithecoctenium echinatum (Jacq.) K. Schum.: Costa Rica, Cuba.

*PROSPODIUM PLAGIOPUS (Mont.) Arth. No. Amer. Flora 7: 162. 1912.
On Tabebuia guayacan (Seem.) Hemsl.: Florida

**PROSPODIUM TABEBUIAE Kern Mycologia 20: 63. 1928.
On Tabebuia berterii (DC.) Britt., T. pentaphylla (L.) Hemsl., T. ? platyantha (Griseb.) Britt.: Puerto Rico, Dominican Republic.

**PROSPODIUM TECOMICOLA (Speg.) Jacks. et Holw. in Jacks. Mycologia 24: 94. 1932.
On Tabebuia heterotricha (DC.) Hemsl.: Honduras.

*PROSPODIUM TRANSFORMANS (Ell. et Ev.) Cumm. Lloydia 3: 66. 1940.
Nephlyctis transformans (Ell. et Ev.) Arth. Jour. Myc. 13: 31. 1907.
On Tecoma stans (L.) H. B. K.: Florida.

PROSPODIUM TUBERCULATUM (Speg.) Arth. No. Amer. Flora 7: 161. 1912.

PUCCINIA ABERRANS Pk. Bot. Gaz. 4: 217. 1879.

PUCCINIA ABREPTA Kern Mycologia 11: 140. 1919.

PUCCINIA ABRUPTA Diet. et Holw. in Diet. Hedwigia 37: 208. 1898.

PUCCINIA ABSICCA Jacks. et Holw. in Arth. Mycologia 10: 144. 1918.

Puccinia absinthii (Hedw. f.) DC.: See P. TANACETI DC.

PUCCINIA ACETOSAE Koern. Hedwigia 15: 184. 1876.
Uredo acetosae Schum. Enum. Pl. Saell. 2: 231. 1803. See NOTE 1, p. 110.

PUCCINIA ACNISTI Arth. Bot. Gaz. 65: 470. 1918.

PUCCINIA ACROPHILA Pk. Bot. Gaz. 6: 227. 1881.

PUCCINIA ADDUCTA Arth. Bull. Torr. Bot. Club 45: 148. 1918.

PUCCINIA ADOXAE Hedw. f. ex DC. Fl. Fr. 2: 220. 1805.

PUCCINIA AEGOPOGONIS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 467. 1918.

PUCCINIA AEMULANS Syd. Ann. Mycol. 4: 31. 1906.

Puccinia aequinoctialis Holw.: See PROSPODIUM AEQUINOCTIALE (Holw.) Cumm.

PUCCINIA AGNITA Arth. Bull. Torr. Bot. Club 42: 590. 1915.

PUCCINIA AGNITIONALIS Jacks. et Holw. in Jacks. Mycologia 24: 108. 1932.
Jamaican reports of P. beckii Mayor belong here.

PUCCINIA AGRIMONIAE (Arth.) Arth. Manual Rusts U. S. and Canada, p. 295. 1934.

Puccinia airae Mayor et Cruch.: See PUCCINIA DESCHAMPSIAE Arth.

**PUCCINIA ALAMEDENSIS J. W. Baxter Lloydia 14: 213. 1951.
On Salvia tiliaefolia Vahl: Guatemala.

PUCCINIA ALBULENSIS Magn. Ber. Deutsch. Bot. Ges. 8: 169. 1890.

PUCCINIA ALETRIDIS Berk. et Curt. in Berk. Grevillea 3: 52. 1874.

**PUCCINIA ALIA Jacks. et Holw. in Jacks. Mycologia 24: 137. 1932.
On Baccharis trinervis (Lam.) Pers.: Guatemala.

PUCCINIA ALLII Rud. Linnaea 4: 392. 1829.
Uredo porri Sow. Engl. Fungi, Tab. 411. 1810.
Puccinia porri Wint. in Rabh. Krypt.-Fl. Ed. 2, I, 1: 200. 1882.

**PUCCINIA AMETABLETA Syd. Ann. Mycol. 23: 314. 1925.
On Thevetia neriifolia L.: Costa Rica.

*PUCCINIA AMMOPHILINA Mains ex Cumm. Mycologia 48: 604. 1956.
Uredo ammophilina Kleb. Krypt.-Fl. Mark Brandenb. Va: 882. 1914.
See NOTE 1, p. 110.
Puccinia ammophilina Mains Bull. Torr. Bot. Club 66: 617. 1939.
Telia described, but without Latin diagnosis.
On Ammophila arenaria (L.) Link, A. breviligulata Fern.: Michigan, Oregon.
Hylander, Jørstad, and Nannfeldt (loc. cit., p. 67) reduce this species to synonymy with P. pygmaea Eriks.

PUCCINIA AMPHIGENA Diet. Hedwigia 34: 291. 1895.
Aecidium yuccae Arth. Bull. Torr. Bot. Club 49: 194. 1922.
This synonymy established by Baxter (Proc. Iowa Acad. Sci. 62: 94-97. 1955.)

PUCCINIA AMPHISPILUSA Diet. et Holw. in Diet. Erythea 3: 79. 1895.

Puccinia amphiospora Cumm.: See P. HYPTIDIS-MUTABILIS Mayor

Puccinia ancizari in No. Amer. Flora 7: 476. 1921 (Non Mayor): See
P. INTERJECTA Jacks.

PUCCINIA ANDINA Diet. et Neger in Engler's Bot. Jahrb. 27: 4. 1899.

PUCCINIA ANDROPOGONIS Schw. Trans. Amer. Phil. Soc. II 4: 295. 1832.
Aecidium onobrychidis Burr. Bot. Gaz. 9: 189. 1884.
Aecidium polygalinum Pk. Bot. Gaz. 6: 275. 1881.
Aecidium xanthoxyli Pk. Bot. Gaz. 6: 275. 1881.
Aecidium aesculi Ell. et Kell. Bull. Torr. Bot. Club 11: 114. 1884.
Cultures by Baxter (Plant Disease Reporter 39: 658. 1955.) established the perfect state of this Aecidium.
Arthur (Manual Rusts U. S. and Canada, pp. 121-122. 1934) sets up nine varieties based largely on aecial hosts and only partly on morphology Cummins (Uredineana 4: 60. 1953) is convinced that "Arthur's varieties are not tenable for the most part."

PUCCINIA ANEMONES-VIRGINIANAE Schw. Schr. Nat. Ges. Leipzig 1: 72. 1822.

PUCCINIA ANGELICAE (Schum.) Fckl. Jahrb. Nass. Ver. Nat. 23-24: 52. 1870.
Uredo angelicae Schum. Enum. Pl. Saell. 2: 233. 1803. Based on telia.

PUCCINIA ANGULATA Diet. et Neger in Engler's Bot. Jahrb. 24: 156. 1897.

PUCCINIA ANGUSTATA Pk. Bull. Buffalo Soc. Nat. Sci. 1: 67. 1873.
Arthur (Manual Rusts U. S. and Canada, p. 195-196.) sets up three varieties based on hosts in large part.

PUCCINIA ANISACANTHI Diet. et Holw. in Holw. Bot. Gaz. 31: 329. 1901.

PUCCINIA ANODAE Syd. Monogr. Ured. 1: 475. 1903.

Puccinia anomala Rostr.: See P. HORDEI Otth

PUCCINIA ANTHEPHORAE Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 137. 1918.

Puccinia antioquiensis Mayor: See P. SUBCORONATA P. Henn.

PUCCINIA ANTIRRHINI Diet. et Holw. in Diet. Hedwigia 36: 298. 1897.

PUCCINIA APOCYNI Diet. et Holw. in Holw. Bot. Gaz. 24: 33. 1897.

PUCCINIA ARABICOLA Ell. et Ev. Jour. Myc. 6: 119. 1891.

PUCCINIA ARACHIDIS Speg. Anal. Soc. Cien. Argent. 17: 90. 1884.

PUCCINIA ARALIAE Ell. et Ev. Jour. Myc. 6: 120. 1891.

PUCCINIA ARECHAVALETAE Speg. Anal. Soc. Cien. Argent. 12: 67. 1881.

PUCCINIA ARENARIAE (Schum.) Wint. Hedwigia 19: 38. 1880.
Uredo arenariae Schum. Enum. Pl. Saell. 2: 232. 1803. Based on telia.

Puccinia arenariicola Jacks.: See P. MODICA Holw.

PUCCINIA AREOLATA Diet. et Holw. in Diet. Bot. Gaz. 19: 304. 1894.
Puccinia nephrophyllidii Mains Bull. Torr. Bot. Club 66: 620. 1939.
Anderson (Iowa State Coll. Jour. Sci. 26: 514. 1952) finds the host involved here is Caltha biflora DC. rather than Nephrophyllidium crista-galli (Menz.) Gilg. and reduces the species to synonymy.

PUCCINIA ARGENTATA (Schultz) Wint. Hedwigia 19: 38. 1880.
Aecidium argentatum Schultz Prodr. Fl. Starg., p. 454. 1806.
The type specimen has telia.

PUCCINIA ARISTIDAE Tracy Jour. Myc. 7: 281. 1893.
Puccinia buchloes Schofield in Webber Report Nebr. State Bd. Agric. 1889: 68. 1890.
Arthur rejects this name (Manual Rusts U. S. and Canada, p. 159. 1934) on the grounds that the host was misdetermined and the name itself little known. Under the Code this reasoning is erroneous. However the fungus involved here was actually described as Puccinia sp. and the binomial P. buchloes supplied provisionally later. Hence it may be rejected under the provisions of Art. 43 of the Code.

PUCCINIA ARNICALIS Pk. Bot. Gaz. 6: 227. 1881.

PUCCINIA ARRACACHAE Lagh. et Lindr. in Lindr. Medd. Stockh. Hogsk. Bot. Inst. 4 (9): 5. 1901.
Puccinia arracacharum (Lindr.) Arth. Amer. Jour. Bot. 5: 476. 1918.

Puccinia arracacharum (Lindr.) Arth.: See P. ARRACACHAE Lagh. et Lindr.

*PUCCINIA ARTEMISIAE-NORVEGICAE Tranz. et Woron. Publ. Riabouchinsky Exped., Bot. 2: 563. 1914.
On Artemisia arctica Less.: Alaska.

PUCCINIA ARTHURELLA Trott. in Sacc. Syll. Fung. 23: 694. 1925.
Puccinia proximella Arth. Bull. Torr. Bot. Club 47: 471. 1920. (non Sydow, 1912).

PUCCINIA ARTHURIANA Jacks. Bot. Gaz. 65: 295. 1918.

PUCCINIA ARTHURII Syd. Monogr. Ured. 1: 775. 1904.
Probably distinct from P. gymnotrichis P. Henn. Specimens referred here (No. Amer. Flora 7: 775. 1926.) belong under P. arthurii.

PUCCINIA ARUNDINARIAE Schw. Schr. Nat. Ges. Leipzig 1: 72. 1822.
Aecidium smilacis Schw. Schr. Nat. Ges. Leipzig 1: 69. 1822.
This Aecidium is assigned here on the basis of an unpublished culture by Cummins.

Puccinia arundinellae (Arth. et Holw.) Barth. : See UREDO ARUNDINELLAE Arth. et Holw.

PUCCINIA ASARINA Kunze in Kunze et Schmidt Myk. Hefte 1: 70. 1817.

PUCCINIA ASPARAGI DC. Fl. Fr. 2: 595. 1805.

PUCCINIA ASPERIOR Ell. et Ev. Bull. Washburn Lab. Nat. Hist. 1: 3. 1884.

PUCCINIA ASTERIS Duby Bot. Gall. 2: 888. 1830. See also P. CNICI-OLERACEI Pers. ex Desm.

Puccinia atra Diet. et Holw. : See P. ESCLAVENSIS Diet. et Holw.

PUCCINIA ATROFUSCA (Dudl. et C. H. Thompson) Holw. Jour. Myc. 10: 228. 1904.
Uromyces atrofusca Dudl. et C. H. Thompson Jour. Myc. 10: 55. 1904.
Telia are present on the type, though not described.

PUCCINIA ATROPUNCTA Pk. et G. W. Clint. in Pk. Bot. Gaz. 4: 171. 1879.

*PUCCINIA AVOCENSIS Cumm. et Greene in Greene Trans. Wis. Acad. Sci., Arts, Letters 43: 177. 1954.
On Stipa spartea Trin. : Wisconsin. See also Aecidium avocense Cumm. et Greene

PUCCINIA AXINIPHYLLI Arth. Bot. Gaz. 40: 201. 1905.

PUCCINIA BACCHARIDIS Diet. et Holw. in Diet. Erythea 1: 250. 1893.

PUCCINIA BACCHARDIS-HIRTELLAE Diet. et Holw. in Holw. Bot. Gaz. 31: 331. 1901.

PUCCINIA BACCHARIDIS-MULTIFLORAE Diet. et Holw. in Holw. Bot. Gaz. 31: 331. 1901.

PUCCINIA BADIA Holw. Jour. Myc. 11: 158. 1905.

PUCCINIA BALLOTAEFLORAE Long Bull. Torr. Bot. Club 29: 116. 1902.

PUCCINIA BALSAMORRHIZAE Pk. Bull. Torr. Bot. Club 11: 49. 1884.

PUCCINIA BARBATULA Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 144. 1918.

PUCCINIA BARDANAE (Wallr.) Cda. Icones Fung. 4: 17. 1840.
Hylander, Jørstad, and Nannfeldt (loc. cit., p. 40) consider this a synonym of P. calcitrapae DC.

Puccinia bartholomaei Diet. : See P. CHLORIDIS Speg.

PUCCINIA BASIPORULA Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 528. 1918.

PUCCINIA BATESIANA Arth. Bull. Torr. Bot. Club 28: 661. 1901.

Puccinia beckii Mayor: See P. AGNITIONALIS Jacks. ex Holw.

**PUCCINIA BELIZENSIS Mains Contrib. Univ. Mich. Herb. 1: 8. 1939.
On Olyra latifolia L. : British Honduras.

PUCCINIA BERBERIDIS-TRIFOLIAE Diet. et Holw. in Holw. Bot. Gaz. 31: 328. 1901.

PUCCINIA BIOCELLATA Vest. ex Cumm. Mycologia 48: 606. 1956.
Uredo plucheae Syd. Ann. Myc. 1: 333. 1903.
Uredo biocellata Arth. Bull. Torr. Bot. Club 33: 517. 1906. See NOTE 1, p. 110.
Puccinia biocellata Vest. Micromycetes Rar. Sel. Nos. 1267, 1368. 1908. Teliospores are present in Vestergren's specimens but were not described.
Puccinia plucheae Arth. Bull. Torr. Bot. Club 49: 194. 1922. Based on uredia.

PUCCINIA BIPORULA J. W. Baxter Lloydia 14: 218. 1951.
Uredo biporula Arth. Bull. Torr. Bot. Club 46: 121. 1919.

PUCCINIA BISTORTAE (Strauss) DC. Fl. Fr. 5: 61. 1815.
Uredo polygoni bistortae Strauss Ann. Wett. Ges. 2: 103. 1810. Strauss describes telia under this name.

PUCCINIA BLASDALEI Diet. et Holw. in Diet. Erythea 1: 248. 1893.
This species has been sometimes considered as synonymous with P. allii Rud. See No. Amer. Flora 7: 373 and Manual Rusts U.S. and Canada, p. 223.

PUCCINIA BLYTTIANA Lagh. Bot. Notiser 1892: 169. 1892.
Puccinia ranunculi Blytt Forh. Vid.-Selsk. Christ. 1882. (5). 12. 1882 (nomen provisorium).

PUCCINIA BOLLEYANA Sacc. Syll. Fung. 9: 303. 1891.

PUCCINIA BOMAREAE P. Henn. Hedwigia 35: 242. 1896.

PUCCINIA BOUTELOUAE (Jennings) Holw. Ann. Mycol. 3: 20. 1905.
See also P. exasperans Holw.

PUCCINIA BOUVARDIAE Griff. Bull. Torr. Bot. Club 20: 297. 1902.

**PUCCINIA BRACHYTELA Syd. Ann. Myc. 23: 315. 1925.
On Otopappus verbesinoides Benth. : Costa Rica

PUCCINIA BRANDEGEI Pk. Bot. Gaz. 7: 44. 1882.

Puccinia bromicola (Mains) Guyot: See PUCCINIA RECONDITA Rob. ex Desm.

Puccinia bromi-maximi Guyot: See PUCCINIA RECONDITA Rob. ex Desm.

*PUCCINIA BUCHNERAE Cumm. Mycologia 33: 385. 1941.
Uredo cumula Arth. Bull. Torr. Bot. Club 49: 195. 1922.
On Buchnera elongata Sw. : Florida.

*PUCCINIA BUPLEURI Rud. Linnaea 4: 514. 1829.
On Bupleurum americanum Coult. et Rose: Alaska, Yukon.

PUCCINIA BURNETTII Griff. Bull. Torr. Bot. Club 29: 298. 1902.

**PUCCINIA CACABATA Arth. et Holw. in Arth. Proc. Amer. Phil. Soc. 64: 179. 1925.
Aecidium gossypii Ell. et Ev. Erythea 5: 6. 1897.
Puccinia stakmanii Presley Phytopath. 33: 385. 1943.
See Hennen and Cummins Mycologia 48: 132-133, 1956 for a discussion of this species and its synonymy.
On Bouteloua aristidoides H. B. K., B. barbata Lag., B. parryi (Fourn.) Griff., B. rothrockii Vasey, Chloris ciliata Sw., C. polydactyla (L.) Sw. : Arizona, Texas, Florida, Bahamas, Dominican Republic, Mexico.

PUCCINIA CALCITRAPAE DC. Fl. Fr. 2: 221. 1805.
Puccinia bardanae Cda. Icon. Fung. 4: 17. 1840.
Puccinia cirsii Lasch in Rabh. Fungi Eur., No. 89. 1859. (non Kirchner 1856).
Hylander, Jørstad, and Nannfeldt (loc. cit., p. 40) adopt the above synonymy.

PUCCINIA CALEAE Arth. Bot. Gaz. 40: 201. 1905.

PUCCINIA CALOCHORTI Pk. Bot. Gaz. 6: 228. 1881.

PUCCINIA CALTHAE Link in Willd. Sp. Plant. (Ed. 4) 6 (pt. 2): 79. 1825.
Aecidium calthae Grev. Fl. Edin., p. 446. 1824. See NOTE 1, p. 110.

PUCCINIA CALTHICOLA Schroet. in Cohn Beitr. Biol. Pfl. 3: 61. 1879.

Puccinia cameliae (Mayor) Arth. : See ANGIOPSORA CAMELIAE (Mayor) Mains

PUCCINIA CAMPANULAE Carm. ex Berk. Smith's Eng. Flora 5 (2): 365. 1836.

Puccinia campanulae novae-zembliae (Jørstad) Arth. : See P. NOVAE-ZEMBLIAE Jørstad

PUCCINIA CANADENSIS Arth. Bull. Torr. Bot. Club 31: 2. 1904.

PUCCINIA CANALICULATA (Schw.) Lagh. Tromsö Mus. Aarsh. 17: 51. 1894.

Puccinia cannae (Wint.) Henn. : See P. THALIAE Diet.

PUCCINIA CARICINA DC. Fl. Fr. 5: 60. 1815.
Uredo caricis Schum. Enum. Pl. Saell. 2: 231. 1803. Telia present. (non U. caricis Pers. Syn. Meth. Fung., p. 225. 1801 = Cintractia caricis (Pers.) P. Magn.)
Puccinia caricis Schroet. in Cohn Krypt.-Fl. Schles. III, 1: 327. 1887. (Non P. caricis Reb. Prodr. Fl. Neomarch., p. 356. 1804.)
The above synonymy follows Hylander, Jørstad, and Nannfeldt (loc. cit. p. 41).
Puccinia paludosa Plowr. Monog. Brit. Ured. Ustil., p. 174. 1889.
Dicaeoma pediculariatum Arth. et Kern No. Amer. Flora 7: 784. 1926.
In addition to the two varieties recognized below, Arthur (Manual Rusts U. S. and Canada, pp. 208-210. 1934) sets up five varieties under Puccinia caricis, based on aecial hosts and slight differences in aeciospores.

PUCCINIA CARICINA DC. var. LIMOSAE (P. Magn.) Jørstad Kgl. N. Vidensk. Selsk. Skr. 38: 17. 1936.
Puccinia limosae P. Magn. Tagebl. Naturf. Vers. München 50: 199. 1877.
Puccinia karelica Tranz. Trav. Mus. Bot. Acad. Sci. St. Petersb. 2: 16. 1905.

PUCCINIA CARICINA DC. var. ULIGINOSA (Juel) Jørstad Skr. Vidensk. Oslo I, 1951, (2): 30. 1952.
Puccinia uliginosa Juel Oefv. Sv. Vet.-Akad. Foerh. 51: 409. 1894.

Puccinia caricis (Schum.) Schroet.: See P. CARICINA DC.

PUCCINIA CARICIS-POLYSTACHYAE Diet. Ann. Mycol. 4: 306. 1906.

PUCCINIA CARICIS-SHEPHERDIAE J. J. Davis Trans. Wis. Acad. Sci. 21: 301. 1924.
Aecidium arctoum Arth. Bull. Torr. Bot. Club 47: 477. 1920.

PUCCINIA CARNEGIANA Arth. Bull. Torr. Bot. Club 42: 587. 1915.

PUCCINIA CARTHAMI Cda. Icon. Fung. 4: 15. 1840.

PUCCINIA CASTILLEJAE Arth. in Blasdale Univ. Calif. Publ. Bot. 7: 133. 1919.
Uredo castillejae Diet. et Holw. in Diet. Erythea 1: 247. 1893.
See NOTE 1, p. 110.

PUCCINIA CAULICOLA Tracy et Gall. Jour. 4: 20. 1888.

PUCCINIA CENCHRI Diet. et Holw. in Holw. Bot. Gaz. 24: 28. 1897.

*PUCCINIA CESATII Schroet. in Cohn Beitr. Biol. Pfl. 3: 70. 1879.
On Bothriochloa ischaemum (L.) Keng: Texas.

PUCCINIA CHAETOCHLOAE Arth. Bull. Torr. Bot. Club 34: 585. 1907.

PUCCINIA CHAMAESARACHAE Syd. Monogr. Ured. 1: 263. 1902.

PUCCINIA CHASEANA Arth. et Fromme Torreya 15: 264. 1915.

PUCCINIA CHELONIS Diet. et Holw. in Diet. Hedwigia 36: 297. 1897.

Puccinia chichenensis Mains: See P. GUARANITICA Speg.

PUCCINIA CHLORIDIS Speg. Rev. Argent. Hist. Nat. 1: 172. 1891.
Puccinia bartholomaei Diet. Hediwgia 31: 290. 1892.
The treatment of this species follows Hennen and Cummins Mycologia 48: 146. 1956.

PUCCINIA CHONDRILLINA Bub. et Syd. Oesterr. Bot. Zeits. 51: 17. 1901.

PUCCINIA CHRYSANTHEMI Roze Bull. Soc. Myc. France 16: 92. 1900.

PUCCINIA CICUTAE Lasch in Klotzsch Herb. Myc. No. 787. 1845.

**PUCCINIA CILIATA Mains Contrib. Univ. Mich. Herb. 1: 9. 1939.
On Cordia alliodora (Ruiz et Pavon) Cham.: British Honduras.

PUCCINIA CINNAMOMEA Diet. et Holw. in Diet. Bot. Gaz. 24: 29. 1897.

PUCCINIA CIRCAEAE Pers. Syn. Meth. Fung., p. 228. 1801.

PUCCINIA CIRCINATA Arth. Amer. Jour. Bot. 5: 471. 1918.

**PUCCINIA CIRCUMDATA Mains Carnegie Inst. Wash. Publ. 461: 101. 1935.
On Panicum fasciculatum Sw.: Cuba, Panama, Puerto Rico.

PUCCINIA CIRSII Lasch in Rabh. Fungi Eur. No. 89. 1859.
See also P. calcitrapae DC.

PUCCINIA CLADII Ell. et Tracy in Ell. et Ev. Bull. Torr. Bot. Club 22: 61. 1895.

PUCCINIA CLAVIFORMIS Lagh. Tromsö Mus. Arsh. 17: 53. 1895.
Aecidium solanitum Schw. ex Berk. et Curt. Jour. Acad. Phil. II. 2: 283. 1853. Nomen nudum.
Puccinia solanita Arth. Mycologia 14: 19. 1922.

*PUCCINIA CLAYTONIICOLA Cumm. Bull. Torr. Bot. Club 79: 218. 1952.
On Claytonia lanceolata Pursh: Wyoming, British Columbia.

PUCCINIA CLINTONII Pk. Ann. Report N. Y. State Mus. 28: 61. 1876.

PUCCINIA CNICI H. Mart. Prodr. Fl. Mosq. Ed. 2, p. 227. 1817.

PUCCINIA CNICI-OLERACEI Pers. ex Desm. Cat. Pl. Omis., p. 24. 1823.
Puccinia asteris Duby Bot. Gall. p. 888. 1830.
Puccinia millefolii Fckl. Jahrb. Nass. Ver. Nat. 23-24: 55. 1869.
Puccinia ptarmicae Karst. Bidr. Känned. Finl. Nat. Folk 31: 41. 1879.
Hylander, Jørstad, and Nannfeldt (loc. cit. p. 44) reduce the three species above to synonymy as indicated. This has not been followed in American practice.

Puccinia cockerelliana Bethel ex Arth.: See PUCCINIA RECONDITA Rob. ex Desm.

PUCCINIA COELOPLEURI Arth. Bull. Torr. Bot. Club 46: 116. 1919.

PUCCINIA COGNATA Syd. Monogr. Ured. 1: 172. 1902.

PUCCINIA COLLINSIAE P. Henn. Hedwigia 37: 269. 1898.
Aecidium collinsiae Ell. et Ev. Bull. Washb. Lab. Nat. Hist. 1: 4. 1884.
See NOTE 1, p. 110.

PUCCINIA COLUMBIENSIS Ell. et Ev. Proc. Acad. Nat. Sci. Phil. 1893: 153. 1893.
Puccinia maculosa Schw. Trans. Amer. Phil. Soc. II, 4: 295. 1832. (Non Roehling, 1813).

PUCCINIA COMANDRAE Pk. Bull. Torr. Bot. Club 11: 49. 1884.

PUCCINIA COMMELINAE Holw. Ann. Mycol. 2: 393. 1904.

PUCCINIA COMMUTATA Syd. Monogr. Ured. 1: 201. 1902.

PUCCINIA CONCINNA Arth. Bot. Gaz. 40: 205. 1905.

PUCCINIA CONCRESCENS Ell. et Ev. ex Arth. Mycologia 7: 240. 1915.

PUCCINIA CONFRAGA Arth. et Cumm. Ann. Mycol. 31: 43. 1933.

PUCCINIA CONGLOMERATA (Strauss) Roehling Deutsch. Fl. Ed. 2. 3 (pt. 3): 130. 1813.

Uredo conglomerata Strauss Ann. Wetter. Ges. 2: 100. 1810.
Telia present on the type.
Puccinia conglomerata Schmidt et Kunze Deutsch. Schwämme 8: 4. 1818.

Puccinia connersii Savile: See P. PRAEGRACILIS Arth. var. CONNERSII Savile

PUCCINIA CONOCLINII Seym. ex Burr. Bot. Gaz. 9: 191. 1884.

PUCCINIA CONSIMILIS Ell. et Ev. Jour. Myc. 6: 120. 1891.

PUCCINIA CONSOBRINA Arth. et Holw. in Arth. Mycologia 10: 129. 1918.

PUCCINIA CONSPICUA Mains Mycologia 25: 408. 1933.
Aecidium conspicuum Arth. Bull. Torr. Bot. Club 45: 153. 1918.
See NOTE 1, p. 110.

PUCCINIA CONVOLVULI Cast. Obs. 1: 16. 1842.
Uredo betae convolvuli Pers. Syn. Meth. Fung., p. 221. 1801.
See NOTE 1, p. 110.

PUCCINIA COOPERIAE Long Bull. Torr. Bot. Club 29: 110. 1902.

PUCCINIA CORDIAE Arth. Mycologia 8: 17. 1916.

PUCCINIA CORNUTA Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 533. 1918.

PUCCINIA CORONATA Cda. Icon. Fung. 1: 6. 1837.
Arthur lists (Manual Rusts U. S. and Canada, p. 154) ten form-species or races which have not been recognized here. In addition the following four varieties have been set up.

PUCCINIA CORONATA Cda. var. AVENAE Fraser et Led. Sci. Agric. 13: 315. 1933.

PUCCINIA CORONATA Cda. var. BROMI Fraser et Led. Sci. Agric. 13: 316-318. 1933.

PUCCINIA CORONATA Cda. var. CALAMAGROSTIS Fraser et Led. Sci. Agric. 13: 316. 1933.

PUCCINIA CORONATA Cda. var. ELEAGNI Fraser et Led. Sci. Agric. 13: 318-319. 1933.

**PUCCINIA COSTINA Cumm. Mycologia 48: 605. 1956.
Uredo costina Syd. Ann. Mycol. 14: 355. 1916. See NOTE 1, p. 110.
Puccinia costina Cumm. Mycologia 33: 381. 1941. Latin diagnosis not provided.
On Costus sp.: Costa Rica.

PUCCINIA CRANDALLII Pam. et Hume in Hume Proc. Davenport Acad. 7: 250. 1899.

PUCCINIA CRASSIPES Berk. et Curt. in Berk. Grevillea 3: 54. 1874.

PUCCINIA CREPIDIS-MONTANAE Magn. ex E. Fischer Beitr. Krypt. Schweiz 2 (2): 212. 1904.

Puccinia cressae Lagh.: See P. TUYUTENSIS Speg.

PUCCINIA CRUCIFERARUM Rudolphi Linnaea 4: 391. 1829.

PUCCINIA CRYPTANDRI Ell. et Barth. Erythea 5: 47. 1897.
Uromyces simulans Pk. Bot. Gaz. 4: 127. 1879. Based on uredia only.
Puccinia simulans Barth. No. Amer. Ured. No. 32. 1922.

PUCCINIA CRYPTANTHES Diet. et Holw. in Diet. Erythea 1: 249. 1893.

PUCCINIA CRYPTOTAENIAE Pk. Bull. Buffalo Soc. Nat. Hist. 1: 66. 1873.

**PUCCINIA CUILAPENSIS Cumm. Bull. Torr. Bot. Club 70: 74. 1943.
On Salvia gracilis Benth., S. mocinoi Benth.: Guatemala.

PUCCINIA CUPHEAE Holw. Ann. Mycol. 2: 393. 1904.

PUCCINIA CYANI Pass. in Rabh. Fungi Eur. No. 1767. 1874.
Uredo cyani Schleich. Pl. Crypt. Helv. No. 95. 1805. Nomen nudum.
Uredo cyani DC. in Lam. et DC. Syn. Pl. Gall., p. 47. 1806. See NOTE 1, p. 110.

PUCCINIA CYNODONTIS Lacroix ex Desm. Pl. Crypt. France II No. 655. 1859.

PUCCINIA CYPERI Arth. Bot. Gaz. 16: 226. 1891.

PUCCINIA CYPERI-TAGETIFORMIS Kern Mycologia 11: 138. 1919.
Uredo cyperi-tagetiformis P. Henn. Bot. Jahrb. 34: 598. 1905.
See NOTE 1, p. 110.

PUCCINIA CYPRIPEDII Arth. et Holw. in Arth. Bull. Iowa Agric. Coll. Dept. Bot. 1884: 156. 1884.

Puccinia dactylidis Gäum.: See PUCCINIA GRAMINIS Pers.

PUCCINIA DAYI G. W. Clint. ex Pk. Ann. Report N. Y. State Mus. 28: 60. 1876.

PUCCINIA DECORA Diet. et Holw. in Diet. Hedwigia 37: 202. 1898.

PUCCINIA DEFORMATA Berk. et Curt. in Berk. Jour. Linn. Soc. 10: 357. 1869.

PUCCINIA DEGENER Mains et Holw. ex Cumm. Mycologia 48: 605. 1956.
Puccinia degener Mains et Holw. in Arth. Amer. Jour. Bot. 5: 482. 1918.
Based on uredia.
Uredo degener Arth. No. Amer. Flora 7: 616. 1924.
Puccinia degener Mains et Holw. ex Cumm. Bull. Torr. Bot. Club 70: 75. 1943. Telia first described, but without Latin diagnosis.

PUCCINIA DELICATULA (Arth.) Sacc. et Trott. in Sacc. Syll. Fung. 21: 657. 1912.

PUCCINIA DELICATULA var. NIVEOIDES (Cumm.) J. W. Baxter in Baxter et Cumm. Lloydia 14: 207. 1951.
Puccinia niveoides Cumm. Bull. Torr. Bot. Club 67: 611. 1940.
On Salvia cinnabarina M. et G.: Guatemala.

PUCCINIA DELPHINII Diet. et Holw. in Diet. Hedwigia 32: 29. 1893.

PUCCINIA DENTARIAE (Alb. et Schw.) Fckl. Jahrb. Nass. Ver. Nat. 25-26: 295. 1871.
Uredo dentariae Alb. et Schw. Consp. Fung. Nisk., p. 129. 1805.
Telia present.

Puccinia depallens Arth. et Holw.: See PROSPODIUM DEPALLENS (Arth. et Holw.) Cumm.

PUCCINIA DESCHAMPSIAE Arth. Bull. Torr. Bot. Club 37: 570. 1910.
Uredo airae Lagh. Jour. de Bot. 2: 432. 1888. See NOTE 1, p. 110.
Puccinia airae Mayor et Cruch. in Cruch. Bull. Soc. Vaud. Sci. 51: 628. 1917.
Puccinia poae-sudeticae var. airae Arth. Manual Rusts U. S. and Canada, p. 151. 1934.

PUCCINIA DESMANTHODII Diet. et Holw. in Holw. Bot. Gaz. 31: 334. 1901.

PUCCINIA DETONSA Arth. et Holw. in Arth. Mycologia 10: 130. 1918.

PUCCINIA DICHELOSTEMMAE Diet. et Holw. in Diet. Erythea 3: 78. 1895.

PUCCINIA DICHONDRAE Mont. in C. Gay Hist. Fis. Polit. Chile 8: 46. 1852.

PUCCINIA DICHROMENAE Jacks. in Jacks. et Whetz. Brit. Myc. Soc. 13: 16. 1928.
Uredo dichromenae Arth. Bull. Torr. Bot. Club 31: 5. 1904.
See NOTE 1, p. 110.

PUCCINIA DIETELII Sacc. et Syd. in Sacc. Syll. Fung. 14: 358. 1899.
Puccinia chloridis Diet. Hedwigia 31: 290. 1892. (Non Speg. 1891.)
Hennen and Cummins (Mycologia 48: 137-138. 1956) divide the species previously known as P. chloridis Speg. into two on morphological grounds, P. dietelii Sacc. et Syd. as above and P. chloridis Speg. (q. v.)

PUCCINIA DIFFORMIS Kunze in Kunze et Schmidt Myk. Hefte 1: 71. 1817.

PUCCINIA DIOICAE P. Magn. Amt. Ber. 50 Versammt. D. Naturf. Ärzte München, p. 199. 1877.
Puccinia extensicola Plowr. Brit. Ured. Ustil., p. 181. 1889.
We follow Hylander, Jørstad, and Nannfeldt (loc cit. p. 48) in accepting P. dioicae as the correct name for the species. Arthur (Manual Rusts U. S. and Canada, pp. 197-198. 1934) states that the species is morphologically homogeneous but recognizes ten varieties based chiefly on aecial hosts.

PUCCINIA DISCRETA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 309. 1918.

PUCCINIA DISTICHLIDIS Ell. et Ev. Proc. Acad. Nat. Sci. Phil. 1893: 152. 1893.

PUCCINIA DISTORTA Holw. Ann. Mycol. 3: 22. 1905.

PUCCINIA DIUTINA Mains et Holw. in Arth. Mycologia 10: 136. 1918.

PUCCINIA DOCHMIA Berk. et Curt. Proc. Amer. Acad. 4: 126. 1858.

PUCCINIA DOLOSA Arth. et Fromme Torreya 15: 262. 1915.

Puccinia dominicana Gonz.-Frag. et Cif.: See P. LEONTIDICOLA P. Henn.

Puccinia dondiae Arth.: See P. GLOBOSIPES Pk.

PUCCINIA DOUGLASII Ell. et Ev. Proc. Acad. Nat. Sci. Phil. 1893: 152. 1893

PUCCINIA DRABAE Rudolphi Linnaea 4: 115. 1829.

PUCCINIA DRACUNCULI Fahrendorf Ann. Mycol. 39: 181. 1941.
On Artemisia dracunculoides Pursh: Wisconsin west to Washington and south to New Mexico and California.

**PUCCINIA DYSCHORISTES Cumm. Bull. Torr. Bot. Club 70: 75. 1943.
On Dyschoriste quadrangularis (Oerst.) Kuntze: Guatemala.

PUCCINIA EATONIAE Arth. Jour. Myc. 10: 18. 1904.
Aecidium indecisum Arth. Bull. Torr. Bot. Club 47: 474. 1920.
Mains (Mycologia 24: 212-213, 1932) establishes two varieties

based on size of aeciospores and aecial hosts, Puccinia eatoniae Arth. var. ranunculi Mains and P. eatoniae Arth. var. myosotidis Mains.

*PUCCINIA ECHEVERIAE Linder Mycologia 30: 667. 1938.
On Echeveria caespitosa (Haw.) DC., E. farinosa Lindl.: California.

PUCCINIA ECHINOPTERIDIS Holw. Jour. Myc. 10: 164. 1904.

PUCCINIA EFFUSA Diet. et Holw. in Diet. Erythea 3: 81. 1895.

Puccinia egenula (Arth.) Barth.: See UREDO EGENULA Arth.

PUCCINIA EGREGIA Arth. Bot. Gaz. 40: 204. 1905.

PUCCINIA EGRESSA Arth. Bull. Torr. Bot. Club 46: 108. 1919.

**PUCCINIA EKMANII Kern, Cif. et Thurston Ann. Mycol. 31: 11. 1933.
On Leersia monandra Sw.: Dominican Republic.

Puccinia elatipes Arth. et Holw.: See PROSPODIUM ELATIPES (Arth. et Holw.) Cumm.

PUCCINIA ELECTRAE Diet. et Holw. in Holw. Bot. Gaz. 31: 333. 1901.

PUCCINIA ELEOCHARIDIS Arth. Bull. Iowa Agric. Coll. Dept. Bot. 1884: 156. 1884.

PUCCINIA ELLISIANA Thuem. Bull. Torr. Bot. Club 6: 215. 1878.

PUCCINIA ELLISII De T. in Sacc. Syll. Fung. 7: 651. 1888.

PUCCINIA ELYMI West. Bull. Acad. Roy. Belge 18 (2): 409. 1951.
This species should be considered distinct from the Puccinia recondita (P. rubigo-vera) complex because of its multicellular teliospores. See Cummins and Caldwell Phytopathology 46: 81-82. 1956.

PUCCINIA ELYTRARIAE P. Henn. Hedwigia 34: 320. 1895.

PUCCINIA EMACULATA Schw. Trans. Amer. Phil. Soc. II 4: 295. 1832.

PUCCINIA EMILIAE P. Henn. Hedwigia 37: 278. 1878.

PUCCINIA ENCELIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 32. 1897.

**PUCCINIA ENIXA Cumm. Bull. Torr. Bot. Club 79: 220. 1952.
On Baccharis braunii (Polak.) Standl.: Costa Rica.

PUCCINIA EPICAMPIS Arth. Bull. Torr. Bot. Club 28: 662. 1901.

PUCCINIA EPILOBII DC. Fl. Fr. 5: 61. 1815.

PUCCINIA ERIGENIAE (Orton) Arth. Bull. Torr. Bot. Club 48: 33. 1921.

PUCCINIA ERIOPHYLLI Jacks. Brooklyn Bot. Gard. Mem. 1: 246. 1918.

**PUCCINIA ERITRAENSIS Paz. in Engler's Bot. Jahrb. 17: 14. 1893.
On Hyparrhenia dissoluta (Ness.) Kunth: Honduras.

PUCCINIA ERRATICA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 294. 1918.

PUCCINIA ESCLAVENSIS Diet. et Holw. in Holw. Bot. Gaz. 24: 29. 1897.
Puccinia atra Diet. et. Holw. in Holw. Bot. Gaz. 24: 29. 1897.
(non Puccinia atra Spreng. Syst. 4: 569. 1827.)

PUCCINIA ESPINOSARUM Diet. et Holw. in Holw. Bot. Gaz. 31: 332. 1901.

Puccinia euphorbiae P. Henn. var. longipes Syd. : See P. LONGIPEDICELLATA Barth.

PUCCINIA EUROTIAE Griff. Bull. Torr. Bot. Club 34: 210. 1907.

PUCCINIA EUTREMAE Lindr. Acta Soc. Fauna Fl. Fenn. 22 (3): 9. 1902.

PUCCINIA EVADENS Hark. Bull. Calif. Acad. 1: 34. 1884.

PUCCINIA EXASPERANS Holw. Ann. Mycol. 3: 21. 1905.
Arthur (Manual Rusts U.S. and Canada, p. 173. 1934.) considered this species synonymous with P. boutelouae (Jennings) Holw., but Hennen and Cummins (Mycologia 48: 140. 1956) decide that it is distinct.

PUCCINIA EXILIS Syd. Monogr. Ured. 1: 481. 1903.

PUCCINIA EXIMIA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 488. 1918.

PUCCINIA EXORNATA Arth. Bull. Torr. Bot. Club 38: 370. 1911.

PUCCINIA EXPANSA Link in Willd. Sp. Plant. 6 (2): 75. 1825.

Puccinia extensicola Plowr. : See P. DIOICAE P. Magn.

Puccinia fallaciosa Arth. : See P. FALLAX Arth.

PUCCINIA FALLAX Arth. in Mains Carnegie Inst. Wash. Publ. 461: 103. 1935.
Puccinia fallaciosa Arth. Mycologia 9: 84. 1917. (Non Thuem.)

**PUCCINIA FARAMEAE Kern, Cif., et Thurston Ann. Mycol. 31: 13. 1933.
On Faramea occidentalis (L.) Rich. : Dominican Republic.

PUCCINIA FARINACEA Long Bull. Torr. Bot. Club 29: 115. 1902.
Puccinia prospera Arth. Bull. Torr. Bot. Club 46: 118. 1919. See Baxter and Cummins Lloydia 14: 219. 1951.

PUCCINIA FERGUSSONII Berk. et Br. Ann. Mag. Nat. Hist. IV. 15: 35. 1875.

PUCCINIA FEROX Diet. et Holw. in Holw. Bot. Gaz. 31: 333. 1901.

PUCCINIA FESTUCAE Plowr. Grevillea 21: 109. 1893.
Uredo festucae DC. Fl. Fr. 6: 82. 1815. See NOTE 1, p. 110.

PUCCINIA FIDELIS Arth. Bull. Torr. Bot. Club 38: 369. 1911.

PUCCINIA FILIOLA Mains et Holw. in Arth. Amer. Jour. Bot. 5: 482. 1918.

PUCCINIA FILOPES Arth. et Holw. in Arth. Mycologia 10: 131. 1918.

PUCCINIA FIMBRISTYLIDIS Arth. Bull. Torr. Bot. Club 33: 28. 1906.

*PUCCINIA FISCHERI Cruch. et Mayor Bull. Soc. Vaud. Nat. 44: 471. 1909.
Puccinia lyngei Jørstad Rept. Sci. Res. Norw. Exp. Novaya Zemlya 1921, No. 18. 1923.
On Saxifraga oppositifolia L. : Yukon.

PUCCINIA FLACCIDA Berk. et Br. Jour. Linn. Soc. 14: 91. 1873.

PUCCINIA FLAVERIAE Jacks. Mycologia 14: 117. 1922.

**PUCCINIA FLAVOVIRENS Jacks. et Holw. in Jacks. Mycologia 18: 142. 1926.
On Cyperus ferax Rich., C. thrysiflorus Jungh. : Guatemala, Mexico.

PUCCINIA FRASERI Arth. Bull. Torr. Bot. Club 42: 591. 1915.

PUCCINIA FRATERNA Jacks. Bot. Gaz. 65: 297. 1918.

PUCCINIA FUCHSIAE Syd. et Holw. in Syd. Ann. Mycol. 4: 30. 1906.

PUCCINIA FUIRENAE Cke. Grevillea 6: 137. 1878.

PUCCINIA FUIRENICOLA Arth. ex Kern, Cif., et Thurston Ann. Mycol. 31: 13. 1933.
Puccinia fuirenicola Arth. Bull. Torr. Bot. Club 46: 109. 1919.
This name is based on uredia only.

PUCCINIA FUMOSA Holw. Ann. Mycol. 3: 23. 1905.

PUCCINIA FUSCATA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 486. 1918.

PUCCINIA FUSCELLA Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 157. 1918.

Puccinia gaillardiae (Diet. et Holw.) Barth. : See UREDO GAILLARDIAE Diet. et Holw.

PUCCINIA GEMELLA Diet. et Holw. ex Syd. Monogr. Ured. 1: 541. 1903.

PUCCINIA GENTIANAE (Strauss) Roehling Deutsch. Fl. ed. 2, 3 (2): 131. 1813.
Uredo gentianae Strauss Ann. Wett. Ges. 2: 102. 1810. The type here contains telia according to Hylander, Jørstad, and Nannfeldt (loc. cit. p. 51).
Puccinia gentianae Link in Willd. Sp. Pl. 6 (2): 73. 1825.
Puccinia probabilis Arth. et Cumm. Ann. Mycol. 31: 42. 1933.
The host is Gentiana and not Veronica.

PUCCINIA GENTILIS Arth. Bull. Torr. Bot. Club 46: 118. 1919.

**PUCCINIA GEOPHILAE Rac. Parasit. Algen Pilze Javas II, p. 27. 1900.
On Geophila herbacea (Jacq.) Schum. : Dominican Republic.

PUCCINIA GIGANTEA Karst. Bidr. Finl. Nat. Folk 31: 42. 1879.

PUCCINIA GIGANTISPORA Bub. Sitz. Boehm. Ges. Wiss. 1901 (2): 9. 1901.

PUCCINIA GILIAE Hark. Bull. Calif. Acad. 1: 34. 1884.

PUCCINIA GILVA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 479. 1918.

PUCCINIA GLABELLA Holw. No. Amer. Ured. 1: 76. 1907.

Puccinia gladioli Cast. : See AECIDIUM VALERIANELLAE Biv.

PUCCINIA GLOBOSIPES Pk. Bull. Torr. Bot. Club 12: 34. 1885.
Puccinia dondiae Arth. Bull. Torr. Bot. Club 42: 592. 1915.
The host of this species is now known to be Lycium and not Suaeda (or Dondia).
Puccinia grayiae (Arth.) Arth. Manual Rusts U. S. and Canada, p. 282. 1934. The host of this species is Lycium and not Grayia.

PUCCINIA GLOBULIFERA Arth. Bot. Gaz. 40: 200. 1905.

Puccinia glumarum (Schmidt) Erikss. et E. Henn. : See P. STRIIFORMIS West.

Puccinia gnaphalii (Speg.) P. Henn. : See P. GNAPHALIICOLA P. Henn.

PUCCINIA GNAPHALIICOLA P. Henn. Hedwigia 38 (Beibl.): 68. 1899.
Uredo gnaphalii Speg. Anal. Soc. Cien. Argent. 12: 73. 1881. See NOTE 1, p. 110.
Puccinia gnaphalii P. Henn. Hedwigia 41 (Beibl.) : 66. 1902. Based on the above Uredo.

PUCCINIA GOUANIAE Holw. Ann. Mycol. 3: 21. 1905.

PUCCINIA GRAMINELLA Diet. et Holw. in Diet. Erythea 3: 80. 1895.

PUCCINIA GRAMINIS Pers. Syn. Meth. Fung., p. 228. 1801.
Puccinia dactylidis Gäum. Ber. Schweiz. Bot. Gesell. 55: 79. 1945.
In addition to Puccinia graminis Pers. var. phlei-pratensis (Erikss. et E. Henn.) Stak. et Piem. recognized by Arthur (Manual Rusts U. S. and Canada, p. 176. 1934) many other forms have been set up as varieties, subspecies, etc. These are based in large part on host differences or on minor morphological details. We have not attempted to go into this complex situation in the present paper.

PUCCINIA GRANULISPORA Ell. et Gall. ex Ell. et Ev. Bull. Torr. Bot. Club 22: 61. 1895.

**PUCCINIA GRATA Arth. et Cumm. Ann. Mycol. 31: 42. 1933.
On Salvia concolor Lamb: Mexico.

Puccinia grayiae (Arth.) Arth. : See P. GLOBOSIPES Pk.

PUCCINIA GRINDELIAE Pk. Bot. Gaz. 4: 127. 1879.
Puccinia wentii Gäum. Ber. Schweiz. Bot. Ges. 57: 246. 1947.

PUCCINIA GRUMOSA Syd. et Holw. in Syd. Monogr. Ured. 1: 641. 1903.

**PUCCINIA GUARANITICA Speg. Anal. Soc. Cien. Argent. 26: 12. 1888.
Puccinia chichenensis Mains Carnegie Inst. Wash. Publ. 461: 100. 1935.
On Gouinia guatemalensis (Hack.) Swallen, G. ramosa Swallen: Honduras, Mexico. See and Hennen and Cummins (Mycologia 48: 133-134. 1956) for a discussion of this species.

PUCCINIA GUARDIOLAE Diet. et Holw. in Holw. Bot. Gaz. 31: 334. 1901.

PUCCINIA GUILLEMINEAE Diet. et Holw. in Holw. Bot. Gaz. 24: 34. 1897.

PUCCINIA GULOSA Jacks. in Arth. Bull. Torr. Bot. Club 47: 470. 1920.

*PUCCINIA GYMNANDRAE Tranz. Scripta Bot. Horti. Univ. Imper. Petrop. 3: 137. 1891.
On Lagotia glauca Gaertn. : Alaska.

PUCCINIA GYMNOLOMIAE Arth. Bot. Gaz. 40: 200. 1905.
Puccinia gymnolomiae Diet. et. Holw. in Garrett Fungi Utah. No. 15. 1904. (nomen nudum).

Puccinia gymnotrichis P. Henn. Hedwigia 35: 242. 1896. Does not occur in North America. See P. arthurii Syd.

**PUCCINIA HACKELIAE Cumm. Bull. Torr. Bot. Club 67: 610. 1940.
On Hackelia mexicana (C. et S.) I. M. Johnst. : Guatemala.

PUCCINIA HALENIAE Arth. et Holw. in Arth. Bull. Geol. Nat. Hist. Surv. Minn. 3: 30. 1887.

PUCCINIA HARKNESSII Vize Grevillea 7: 11. 1878.

PUCCINIA HELIANTHELLAE Arth. Bull. Torr. Bot. Club 31: 4. 1904.
Trichobasis helianthellae Pk. Bot. Gaz. 7: 45. 1882. See NOTE 1, p. 110.

PUCCINIA HELIANTHI Schw. Schr. Nat. Ges. Leipzig 1: 73. 1822.

PUCCINIA HELICONIAE Arth. Bull. Torr. Bot. Club 45: 144. 1918.
Uredo heliconiae Diet. Hedwigia 36: 35. 1897. See NOTE 1, p. 110.

PUCCINIA HELIOTROPII Kern et Kellerm. in Kern Jour. Myc. 13: 23. 1907.

*PUCCINIA HENRYAE Cumm. Bull. Torr. Bot. Club 68: 468. 1941.
On Henrya imbricans Donn. Sm. : Guatemala.

PUCCINIA HETEROSPORA Berk. et Curt. Jour. Linn. Soc. Bot. 10: 356. 1868.

PUCCINIA HEUCHERAE (Schw.) Diet. Ber. Deutsch. Bot. Ges. 9: 42. 1891.
Uredo heucherae Schw. Schr. Nat. Ges. Leipzig 1: 71. 1822. Telia present.

PUCCINIA HEUCHERAE var. AUSTROBERINGIANA Savile Canadian Jour. Bot. 32: 407. 1954.
For hosts and distribution see Savile Canadian Jour. Bot. 32: 406. 1954.

PUCCINIA HEUCHERAE var. HEUCHERAE
Puccinia tiarellae Berk. et Curt. Grevillea 3: 53. 1874.
Puccinia spreta Pk. Ann. Report. N. Y. State Mus. 29: 67. 1878.
Puccinia congregata Ell. et Hark. Bull. Calif. Acad. 1: 26. 1884.
For description, additional hosts and distribution see Savile (loc. cit.)

PUCCINIA HEUCHERAE var. LITHOPHRAGMAE (Holw.) Savile Canadian Jour. Bot. 32: 409. 1954.
Puccinia lithophragmae Holw. No. Amer. Ured. 1: 51. 1906.

PUCCINIA HEUCHERAE var. SAXIFRAGAE (Schlecht.) Savile Canadian Jour. Bot. 32: 408. 1954.
Puccinia saxifragae Schlecht. Fl. Berol. 2: 134. 1824.
For additional hosts and distribution see Savile (loc. cit.).

PUCCINIA HIASCENS Arth. Bull. Torr. Bot. Club 46: 471. 1920.

PUCCINIA HIERACII (Roehling) Mart. Prodr. Fl. Mosq. Ed. 2, p. 227. 1817.
Puccinia flosculosorum var. hieracii Roehling Deutsch. Fl. Ed. 2. III 3: 131. 1813.
Uredo hieracii Schum. Enum. Pl. Saell. 2: 232. 1803. See NOTE 1, p. 110.

PUCCINIA HODGSONIANA Kern in Arth. Amer. Jour. Bot. 5: 526. 1918.

Puccinia holboellii (Hornem.) Rostr. : See P. THLASPEOS Schub.

PUCCINIA HOLWAYULA Jacks. Mycologia 24: 163. 1932.
Costa Rican specimens referred to P. oyedaeae Mayor (No. Amer. Flora 7: 431. 1921) belong here.

Puccinia hordei Fckl. : See P. RECONDITA Rob. ex Desm.

PUCCINIA HORDEI Otth Mitth. Nat. Ges. Bern. 1870: 114. 1871.
Puccinia anomala Rostr. in Thuem. Flora 61: 92. 1878. For a discussion of the nomenclature involved for this species see Plant Disease Reporter 30: 373. 1946.

Puccinia hordei-murini Buch. : See PUCCINIA RECONDITA Rob. ex Desm.

PUCCINIA HUBERI P. Henn. Hedwigia 39 (Beibl.): 76. 1900.
For a discussion of the status of this species see Cummins (Mycologia 34: 692-693. 1942.)

PUCCINIA HYDROCOTYLES Cke. Grevillea 9: 14. 1880.
Caeoma hydrocotyles Link in Willd. Sp. Pl. 6 (2): 22. 1825.
See NOTE 1, p. 110.

PUCCINIA HYDROPHYLLI Pk. et G. W. Clint. in Pk. Ann. Report N. Y. State Mus. 30: 54. 1878.

PUCCINIA HYPTIDIS Tracy et Earle Bull. Miss. Agric. Exp. Sta. 34: 86. 1895.
Uredo hyptidis Curt. Amer. Jour. Sci. II. 6: 353. 1848. See NOTE 1, p. 110.

*PUCCINIA HYPTIDIS-MUTABILIS Mayor Mem. Soc. Neuch. Sci. Nat. 5: 496. 1913.
Puccinia amphiospora Cumm. Bull. Torr. Bot. Club 67: 67. 1940.
On Hyptis mutabilis (A. Rich) Briq. : Florida.

PUCCINIA HYSSOPI Schw. Trans. Amer. Phil. Soc. II 4: 296. 1832.

**PUCCINIA ICHNANTHI Mains Bull. Torr. Bot. Club 66: 619. 1939.
On Ichnanthus candicans (Nees) Doell. : British Honduras.

PUCCINIA IDONEA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 305. 1918.

Puccinia ignava (Arth.) Arth. : See UREDO IGNAVA Arth.

PUCCINIA IMPEDITA Mains et Holw. in Arth. Mycologia 10: 135. 1918.

PUCCINIA IMPERSPICUA Syd. Monogr. Ured. 1: 361. 1902.

PUCCINIA IMPOSITA Arth. Bull. Torr. Bot. Club 46: 112. 1919.

**PUCCINIA IMPRESSA Syd. Ann. Mycol. 24: 289. 1926.
On Solanum salviifolium Lam. : Costa Rica.

PUCCINIA INAEQUATA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 309. 1918.

PUCCINIA INANIPES Diet. et Holw. in Holw. Bot. Gaz. 31: 332. 1901.

PUCCINIA INAUDITA Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 535. 1918.

PUCCINIA INCLITA Arth. Bull. Torr. Bot. Club 46: 115. 1919.

Puccinia incomposita (Kern) Barth. : See UREDO INCOMPOSITA Kern

PUCCINIA INCONDITA Arth. Bull. Torr. Bot. Club 45: 148. 1918.

PUCCINIA INERMIS Jacks. et Holw. in Arth. Mycologia 10: 142. 1918.

PUCCINIA INFLATA Arth. Bull. Torr. Bot. Club 33: 516. 1906.

PUCCINIA INFREQUENS Holw. Jour. Myc. 11: 158. 1905.

PUCCINIA INFUSCANS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 463. 1918.

PUCCINIA INSIGNIS Holw. Ann. Mycol. 2: 392. 1904.

PUCCINIA INSITITIA Arth. Mycologia 7: 248. 1915.

PUCCINIA INSPERATA Jacks. Brooklyn Bot. Garden Mem. 1: 253. 1918.

PUCCINIA INSULANA (Arth.) Jacks. Bot. Gaz. 65: 296. 1918.

PUCCINIA INTERJECTA Jacks. Mycologia 24: 148. 1932.
Guatemalan specimens assigned to P. ancizari Mayor in No. Amer. Flora 7: 476. 1921, belong here.

PUCCINIA INTERMIXTA Pk. Bot. Gaz. 4: 218. 1879.

PUCCINIA INTERVENIENS Bethel in Blasdale Univ. Calif. Publ. Bot. 7: 119. 1919.

PUCCINIA INTUMESCENS (Syd.) Holw. No. Amer. Ured. 1: 60. 1907.

PUCCINIA INVAGINATA Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 146. 1918.

PUCCINIA INVELATA Jacks. ex Arth. Bull. Torr. Bot. Club 46: 119. 1919.

PUCCINIA INVESTITA Schw. Trans. Amer. Phil. Soc. II, 4: 296. 1832.

PUCCINIA IOSTEPHANES Diet. et Holw. in Holw. Bot. Gaz. 31: 334. 1901.

PUCCINIA IRIDIS Rab. Deutsch. Krypt. Fl. 1: 23. 1844.
Uredo iridis DC. ex Poir. in Lam. Encyc. 8: 224. 1808. See NOTE 1, p. 110.
Puccinia clavuligerae iridis Wallr. Fl. Crypt. Germ. 2: 223. 1833.
Based on the Uredo name.
Hylander, Jørstad, and Nannfeldt (loc. cit. p. 56) report the aecial stage on Urtica in Norway.

PUCCINIA IRREGULARIS Diet. Hedwigia 36: 33. 1897.

PUCCINIA IRREQUISITA Jacks. ex Arth. Bull. Torr. Bot. Club 48: 32. 1921.

PUCCINIA JALAPENSIS (Holw.) Barth. ex Cumm. Mycologia 48: 604. 1956.
Aecidium jalapense Holw. Ann. Mycol. 2: 392. 1904. Telia present.
Dicaeoma jalapense Arth. No. Amer. Fl. 7: 402. 1920. Telia not described.
Puccinia jalapensis Barth. No. Amer. Ured. No. 2549. 1922.

PUCCINIA JALISCANA Arth. Bot. Gaz. 40: 202. 1905.

PUCCINIA JALISCENSIS Holw. Ann. Mycol. 2: 393. 1904.
Considered a synonym of P. cupheae Holw. in No. Amer. Flora 7: 548, 1922, but appears distinct.

PUCCINIA JOHNSTONII Arth. in Arth. et J. R. Johnston Mem. Torr. Bot Club 17: 149. 1918.

PUCCINIA JONESII Pk. Bot. Gaz. 6: 226. 1881.
Arthur (Manual Rusts U. S. and Canada, p. 317. 1934.) sets up three varieties, P. jonesii typica, P. jonesii cymopteri (Diet. et Holw.), and P. jonesii lindrothii Syd., based on host relations and minor morphological details.

PUCCINIA JUSSIAEAE Speg. Anal. Soc. Cien. Argent. 12: 68. 1881.

Puccinia kaernbachii (P. Henn.) Arth.: See P. POSADENSIS Sacc. et Trott.

PUCCINIA KANSENSIS Ell. et Barth. Erythea 4: 1. 1896.

Puccinia karelica Tranz.: See PUCCINIA CARICINA DC. var. LIMOSAE (P. Magn.) Jørstad

PUCCINIA KOELERIAE Arth. Mycologia 1: 247. 1909.

PUCCINIA KUHNIAE Schw. Trans. Amer. Phil. Soc. II 4: 296. 1832.

PUCCINIA LANTANAE Farl. Proc. Amer. Acad. Sci. 18: 83. 1883.

PUCCINIA LAPATHICOLA Hylander, Jørstad, et Nannf. Opera Bot. 1 (1): 66. 1953.
Puccinia punctiformis Diet. et Holw. in Diet. Erythea 2: 128. 1894.
Non P. punctiformis (Strauss) Roehling 1813.

PUCCINIA LAPSANAE Fckl. Jahr. Nass. Ver. Nat. 15: 13. 1860.
Trichobasis lapsanae Cke. Micro. Fungi, ed. 4, p. 224. 1865.
See NOTE 1, p. 110.

PUCCINIA LATERIPES Berk. et Rav. in Berk. Grevillea 3: 52. 1874.
Uredo ruelliae Berk. et Br. Jour. Linn. Soc. 14: 92. 1873.
See NOTE 1, p. 110.
Puccinia ruelliae Lagh. Tromsø Mus. Aarsh. 17: 71. 1895.

PUCCINIA LATERITIA Berk. et Curt. Jour. Acad. Nat. Sci. Phil. II 2: 281. 1853.

PUCCINIA LAURENTIANA Trel. in Harriman Alas. Exped. Crypt., p. 38. 1904.

**PUCCINIA LAURIFOLIAE Davidson Mycologia 24: 224. 1932.
On Heteropteris laurifolia (L.) Juss.: Guatemala.

Puccinia leonotidis (P. Henn.) Arth.: See P. LEONOTIDICOLA P. Henn.

*PUCCINIA LEONOTIDICOLA P. Henn. in H. Baum Kun-Samb. Exped., p. 2. 1903.
Uredo leonotidis P. Henn. in Engler Pfl. Ost.-Afr. Teil C: 52. 1895. See NOTE 1, p. 110.
Puccinia leonotidis Arth. Mycologia 7: 245. 1915. Based on the above Uredo name.
Puccinia dominicana Gonz.-Frag. et Cif. Bol. R. Soc. Espan. Hist. Nat. 26: 248. 1926.
On Leonotis nepetaefolia (L.) R. Br.: Florida.

PUCCINIA LEPTOCHLOAE Arth. et Fromme Torreya 15: 263. 1915.

PUCCINIA LEPTOSPORA Ricker Jour. Myc. 11: 114. 1905.

**PUCCINIA LEUCADIS Syd. Monogr. Ured. 1: 281. 1902.
On Leucas martinicensis (Jacq.) R. Br.: Dominican Republic.

PUCCINIA LEVEILLEI Mont. in C. Gay Hist. Fis. Polit. Chile 8: 41. 1852.

PUCCINIA LEVIS (Sacc. et Bizz.) Magn. Ber. Deutsch. Bot. Ges. 9: 190. 1891.
Uromyces tricholaenae Gonz. Frag. et Cif. Bol. R. Soc. Esp. Hist. Nat. 25: 357. 1925.

PUCCINIA LIATRIDIS (Arth. et Fromme) Bethel ex Arth. Manual Rusts U. S. and Canada, p. 146. 1934.
Aecidium compositarum liatridis Webber Ann. Report Nebr. Board Agric. 1889: 210. 1890. See NOTE 1, p. 110.
Puccinia liatridis Bethel ex Arth. Mycologia 9: 301. 1917. (*Nomen nudum.*)
Dicaeoma liatridis Arth. et Fromme No. Amer. Flora 7: 326. 1920. The first valid description of telia.

PUCCINIA LIBERTA Kern Mycologia 11: 412. 1919.

PUCCINIA LIGUSTICI Ell. et Ev. Bull. Torr. Bot. Club 22: 363. 1895.

PUCCINIA LIMOSAE Magn. Tagebl. Nat. Vers. München 50: 199. 1877.
Hylander, Jǿrstad, and Nannfeldt (loc. cit. p. 43) treat this as *P. caricina* var. *limosae* Jǿrstad Kgl. n. Vidensk. Selsk. Skr. 38: 17. 1936.

PUCCINIA LINKII Klotzsch Linnaea 8: 490. 1833.

PUCCINIA LITHOSPERMI Ell. et Kell. Jour. Myc. 1: 2. 1885.

PUCCINIA LOBATA Berk. et Curt. in Berk. Grevillea 3: 54. 1874.

PUCCINIA LOBELIAE Gerard ex Pk. Bull. Buffalo Soc. Nat. Sci. 1: 66. 1873.
Puccinia microsperma Berk. et Curt. in Curt. Cat. Plants No. Car., p. 121. 1867. *Nomen nudum.*

PUCCINIA LONGIANA Syd. Hedwigia 40 (Beibl.): 126. 1901.
Segregated from *P. lateripes* Berk. et Rav. as distinct. On *Ruellia tuberosa* L.: Texas.

PUCCINIA LONGIPEDICELLATA Barth. Handbook No. Amer. Ured. Ed. 2, p. 126. 1933.
Puccinia euphorbiae longipes Syd. Ured. No. 1521. 1901.
Bullaria longipes Arth. et Mains No. Amer. Flora 7: 486. 1922.

PUCCINIA LUDOVICIANAE Fahrendorf Ann. Mycol. 39: 181. 1941.
On *Artemisia ludoviciana* Nutt. Segregated from *P. absinthii* (Hedw. f.) DC. for which see *P. tanaceti* DC.

Puccinia lupinicola Gäum.: See P. THELYPODII Cumm.

PUCCINIA LUXURIOSA Syd. Monogr. Ured. 1: 812. 1904.

Puccinia lyngei Jǿrstad: See P. FISCHERI Cruch. et Mayor

PUCCINIA MACRA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 465. 1918.

PUCCINIA MACROPODA Speg. Anal. Soc. Cien. Argent. 10: 8. 1880.
Uredo striolata Speg. Anal. Cien. Argent. 9: 173. 1880. See NOTE 1, p. 110.
Puccinia striolata Arth. Mem. Torr. Bot. Club 17: 142. 1918.
Uredo saphena Arth. et Cumm. Ann. Mycol. 31: 44. 1933. Reported on *Physalis pubescens* L. from Cuba, but the host is probably *Iresine*.

PUCCINIA MACROSPORA Arth. Mycologia 1: 244. 1909.
Non Puccinia macrospora (Lk.) Spreng. Syst. 4: 569. 1827
The fact that Arthur's use of this epithet was antedated was not discovered in time for a new name to be proposed by Cummins (Mycologia 48: 601-608. 1956).

Puccinia maculosa Schw. : See P. COLUMBIENSIS Ell. et Ev.

PUCCINIA MAGNUSIANA Koern. Hedwigia 15: 179. 1876.

PUCCINIA MALVACEARUM Bert. ex Mont. in C. Gay Hist. Fis. Polit. Chile 8: 43. 1852.

PUCCINIA MARIAE-WILSONIAE G. W. Clint. in Pk. Bull. Buffalo Soc. Nat. Sci. 1: 66. 1873.

PUCCINIA MARIAE-WILSONIAE G. W. Clint var. MARIAE-WILSONIAE
This trinomial set up by Savile and Parmelee (Mycologia 48: 573. 1956) under the provisions of Art. 35 of the Code.

PUCCINIA MARIAE-WILSONIAE G. W. Clint var. MONTIAE Savile Mycologia 48: 574. 1956.

PUCCINIA MARIANAE Syd. Hedwigia 40 (Beibl.): 127. 1901.

PUCCINIA MARSDENIAE Diet. et Holw. in Holw. Bot. Gaz. 31: 330. 1901.

PUCCINIA MARYLANDICA Lindr. Medd. Stockh. Hogsk. Bot. Inst. 4 (9): 2. 1901.

PUCCINAI MASSALIS Arth. Bull. Torr. Bot. Club 46: 119. 1919.

PUCCINIA MCCLATCHIEANA Diet. et Holw. in Diet. Erythea 2: 127. 1894.

PUCCINIA MEDELLINENSIS Mayor Mem. Soc. Neuch. Sci. Nat. 5: 497. 1913.

PUCCINIA MEGALOSPORA (Orton) Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 152. 1918.

PUCCINIA MELAMPODII Diet. et Holw. in Holw. Bot. Gaz. 24: 32. 1897.

PUCCINIA MELANCONIOIDES Ell. et Hark. Bull. Calif. Acad. 1: 27. 1884.

Puccinia melanocephala Syd. : See PUCCINIA PHYLLOSTACHYDIS Kusano

PUCCINIA MELANTHERAE P. Henn. Hedwigia 36: 214. 1897.

PUCCINIA MELLIFERA Diet. et Holw. in Diet. Erythea 1: 25. 1893.

PUCCINIA MENTHAE Pers. Syn. Meth. Fung. p. 227. 1801.

PUCCINIA MERTENSIAE Pk. Bot. Gaz. 6: 227. 1881.

PUCCINIA MESNIERIANA Thuem. Myc. Univ. No. 834. 1877.

PUCCINIA MESOMAJALIS Berk. et Curt. ex Pk. Ann. Report N. Y. State Mus. 25: 111. 1873.

PUCCINIA MICRANTHA Griff. Bull. Torr. Bot. Club 29: 299. 1902.

PUCCINIA MICROICA Ell. Jour. Myc. 7: 274. 1893.

PUCCINIA MICROSORA Koern. ex Fckl. Fungi Rhen. No. 2637. 1874.

PUCCINIA MICROSPORA Diet. in Engler's Bot. Jahrb. 27: 101. 1905.
On Imperata hookeri Rupr.: Ariz. In the manual referred to P. kaernbachii (P. Henn.) Arth.

PUCCINIA MILLEFOLII Fckl. Jahrb. Nass. Ver. Nat. 23-24: 55. 1870.
See also P. cnici-oleracei Pers. ex Desm.

PUCCINIA MINUSSENSIS Thuem. Bull. Soc. Nat. Mosc. 53: 214. 1878.

PUCCINIA MINUTA Diet. ex Atk. Bull. Cornell Univ. 3: 19. 1897.

PUCCINIA MINUTISSIMA Arth. Bull. Torr. Bot. Club 34: 587. 1907.

PUCCINIA MIRIFICA Diet. et Holw. in Diet. Erythea 3: 79. 1895.
Uromyces triannulata Berk. et Curt. Grevillea 3: 56. 1874. Based on uredia only.
Puccinia triannulata Jacks. Mycologia 14: 111. 1922.

PUCCINIA MITRATA Syd. Monogr. Ured. 1: 294. 1902.

PUCCINIA MODICA Holw. Jour. Myc. 10: 164. 1904.
Uredo arenariicola P. Henn. Hedwigia 35: 253. 1896. See NOTE 1, p. 110.
Puccinia arenariicola Jacks. Mycologia 19: 63. 1927. Based on the Uredo name.

**PUCCINIA MOGIPHANIS Arth. Bot. Gaz. 65: 469. 1918.
On Achyranthes laguroides Standl.: Nicaragua.

PUCCINIA MONOICA Arth. Mycologia 4: 61. 1912.

PUCCINIA MONTANENSIS Ell. Jour. Myc. 7: 274. 1893.

PUCCINIA MORENIANA Dudl. et C. H. Thompson Jour. Myc. 10: 53. 1904.

PUCCINIA MUSENII Ell. et Ev. Bull. Torr. Bot. Club 27: 61. 1900.

PUCCINIA MUTABILIS Ell. et Gall. Jour. Myc. 5: 67. 1889.

PUCCINIA NANOMITRA Syd. Monogr. Ured. 1: 182. 1902.

PUCCINIA NEOROTUNDATA Cumm. Mycologia 48: 606. 1956.
Puccinia rugosa Speg. Anal. Soc. Cien. Argent. 17: 92. 1884. (Non Billings, 1871.)
Puccinia rotundata Diet. Hedwigia 36: 32. 1897. (Non Bonorden, 1860).

Puccinia nephrophyllidii Mains: See P. AREOLATA Diet. et Holw.

PUCCINIA NESODES Arth. et Holw. in Arth. Mycologia 10: 138. 1918.

Puccinia nivea Holw.: See POLIOMA NIVEA (Holw.) Arth.

Puccinia niveoides Cumm.: See P. DELICATULA var. NIVEOIDES (Cumm.) J. W. Baxter

PUCCINIA NOCCAE Arth. Bot. Gaz. 40: 202. 1905.

PUCCINIA NOCTICOLOR Holw. Ann. Myc. 2: 391. 1904.

PUCCINIA NODOSA Ell. et Hark. Bull. Calif. Acad. 1: 27. 1884.

PUCCINIA NOTHA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 305. 1918.

PUCCINIA NOTOPTERAE Arth. Bull. Torr. Bot. Club 45: 149. 1918.

PUCCINIA NOVAE-ZEMBLIAE Jørstad Rep. Sci. Res. Norw. Exped. Nov. Zemlya 18: 6. 1923.
Puccinia campanulae novae-zembliae Arth. Manual Rusts U. S. and Canada, p. 262. 1934.

PUCCINIA NUDA Ell. et Ev. Jour. Myc. 3: 57. 1887.

PUCCINIA OAHUENSIS Ell. et Ev. Bull. Torr. Bot. Club 22: 435. 1895.
On Digitaria sp. : Puerto Rico. Formerly reported under P. paspalicola (P. Henn.) Arth.

PUCCINIA OAXACANA Diet. et Holw. in Holw. Bot. Gaz. 31: 331. 1901.

PUCCINIA OBESISPORA Arth. Bull. Torr. Bot. Club 45: 147. 1918.

**PUCCINIA OBLATA Mains Contrib. Univ. Mich. Herb. 1: 12. 1939.
On Notoptera scabridula Blake, Otopappus curviflorus (R. Br.) Hemsl. : British Honduras, Guatemala.

PUCCINIA OBLIQUA Berk. et Curt. in Berk. Jour. Linn. Soc. Bot. 10: 356. 1869.

PUCCINIA OBSCURA Schroet. ex Pass. N. Giorn. Bot. Ital. 9: 256. 1877.

PUCCINIA OBSCURATA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 477. 1918.

PUCCINIA OBTECTA Pk. Bull. Buffalo Soc. Nat. Sci. 1: 66. 1873.

**PUCCINIA OBTECTELLA Cumm. Bull. Torr. Bot. Club 67: 609. 1940.
On Scirpus americanus Pers. : Guatemala.

Puccinia obtegens Tul. : See P. PUNCTIFORMIS (Strauss) Roehling

PUCCINIA OENOTHERAE Vize Grevillea 5: 109. 1877.
Arthur (Manual Rusts U. S. and Canada, p. 248. 1934.) sets up the variety heteranthae based on host and minor morphological differences.

PUCCINIA OFFUSCATA Arth. Bull. Torr. Bot. Club 47: 469. 1920.
Uredo zorniae Diet. Hedwigia 38: 257. 1899. See NOTE 1, p. 110.
Puccinia zorniae Barth. No. Amer. Ured. Ed. 1, p. 176. 1928. (Non McAlpine 1906).

PUCCINIA ONOPORDI Syd. Monogr. Ured. 1: 128. 1902.

PUCCINIA OPULENTA Speg. Anal. Soc. Cien. Argent. 9: 170. 1880.

PUCCINIA ORBICULA Pk. et G. W. Clint. in Pk. Ann. Report N. Y. State Mus. 30: 53. 1879.

PUCCINIA ORDINATA Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 530. 1918.

Puccinia ormosiae Arth. : See DICHEIRINIA ORMOSIAE (Arth.) Cumm.

PUCCINIA ORNATA Arth. et Holw. in Arth. Bull. Geol. Nat. Hist. Surv. Minn. 3: 30. 1887.

PUCCINIA ORNATULA Holw. No. Amer. Ured. 1: 67. 1907.

*PUCCINIA ORNITHOGALI-THYRSOIDES Diet. Hedwigia 44: 178. 1905.
On Ornithogalum sp. : Manitoba. On plants grown from bulbs imported from Africa but the rust not persisting.

PUCCINIA ORTONII Jacks. Brooklyn Bot. Gard. Mem. 1: 259. 1918.

PUCCINIA OTOPAPPI Syd. Monogr. Ured. 1: 129. 1902.

PUCCINIA OUDEMANSII Tranz. in Syd. Monogr. Ured. 1: 894. 1904.

PUCCINIA OXALIDIS Diet. et Ell. in Diet. Hedwigia 34: 291. 1895.
Uredo oxalidis Lév. Ann. Sci. Nat. II, 16: 240. 1841. See NOTE 1, p. 110.

PUCCINIA OXYRIAE Fckl. Jahrb. Nass. Ver. Nat. 29-30: 14. 1876.

Puccinia oyedaeae Mayor: See P. HOLWAYULA Jacks.

PUCCINIA PACIFICA Blasd. ex Arth. Bull. Torr. Bot. Club 48: 31. 1921.

PUCCINIA PAGANA Arth. Bull. Torr. Bot. Club 38: 372. 1911.

**PUCCINIA PALICOUREAE Mains Carnegie Inst. Wash. Publ. 461: 102. 1935.
On Palicourea triphylla DC. : British Honduras.

Puccinia pallescens Arth. : See ANGIOPSORA PALLESCENS (Arth.) Mains

*PUCCINIA PALLIDISSIMA Speg. Anal. Soc. Cien. Argent. 12: 69. 1881.
On Stachys coccinea Jacq. : Texas

PUCCINIA PALLOR Arth. et Holw. in Arth. Mycologia 10: 129. 1918.

PUCCINIA PALMERI Diet. et Holw. in Diet. Erythea 7: 98. 1899.

Puccinia paludosa Plowr. : See PUCCINIA CARICINA DC.

PUCCINIA PANICI Diet. Erythea 3: 80. 1895.

PUCCINIA PARADOXICA Ricker Jour. Myc. 11: 114. 1905.

PUCCINIA PARCA Arth. Bull. Torr. Bot. Club 46: 117. 1919..

PUCCINIA PARILIS (Arth.) Arth. Amer. Jour. Bot. 5: 485. 1918.

PUCCINIA PARKERAE Diet. et Holw. in Diet. Erythea 3: 78. 1895.

PUCCINIA PARNASSIAE Arth. Bull. Torr. Bot. Club 31: 3. 1904.
Puccinia parnassiaecola Barth. Handbook No. Amer. Ured., Ed. 1, p. 147. 1928.

*PUCCINIA PAROSELAE Cumm. Bull. Torr. Bot. Club 68: 44. 1941.
On Parosela mollis (Benth.) Heller: California.

PUCCINIA PARTHENICES Jacks. Mycologia 14: 108. 1922.

PUCCINIA PARTHENII Arth. Bull. Torr. Bot. Club 37: 570. 1910.
[Uredo parthenii Speg. Anal. Mus. Nac. Buenos Aires 6: 239. 1899. Excluded, see the following species.]
On Parthenium argentatum A. Gray: Mexico. For other hosts reported for this species in No. Amer. Flora 7: 600, 1922, see the following.

PUCCINIA PARTHENIICOLA Jacks. Mycologia 24: 166. 1932.
Uredo parthenii Speg. Anal. Mus. Nac. Buenos Aires 6: 239. 1919.
On Parthenium hysterophorum L. and P. incanum H.B.K.: Bermuda, Texas, Mexico. Segregated (Jackson, loc. cit.) from the preceding.

Puccinia paspalicola (P. Henn.) Arth.: See P. SUBSTRIATA Ell. et Barth.

PUCCINIA PATTERSONIANA Arth. Bull. Torr. Bot. Club 33: 29. 1906.

**PUCCINIA PAULENSIS Rangel Arch. Jard. Bot. Rio de Janeiro 2: 70. 1918.
On Capsicum annuum L.: Guatemala.

PUCCINIA PAUPERCULA Arth. Bot. Gaz. 40: 206. 1905.

PUCCINIA PAZSCHKEI Diet. Hedwigia 30: 103. 1891.

PUCCINIA PAZSCHKEI Diet. var. HETERISIAE (Jacks.) Savile Canadian Jour. Bot. 32: 410. 1954.
On Saxifraga mertensiana Bong.: Washington, Montana, British Columbia.

PUCCINIA PAZSCHKEI Diet. var. JUELIANA (Diet.) Savile Canadian Jour. Bot. 32: 411. 1954.
Puccinia jueliana Diet. Hedwigia 36: 298. 1897.
On Saxifraga aizoides L.: Greenland; S. ferruginea Graham: British Columbia.

*PUCCINIA PAZSCHKEI Diet. var. OPPOSITIFOLIAE Savile Canadian Jour. Bot. 32: 413. 1954.
On Saxifraga oppositifolia L.: Quebec.

PUCCINIA PAZSCHKEI Diet. var. TRICUSPIDATAE Savile Canadian Jour. Bot. 32: 410. 1954.
Puccinia turrita Arth. et Jacks. in Arth. Bull. Torr. Bot. Club 29: 230. 1902.
On Saxifraga bronchialis L.: British Columbia; S. tricuspidata Rottb.: Alaska, Yukon.

PUCCINIA PENNISETI Zimm. Ber. Land. u. Forstwirts. Deutsch. Ostafrica 1: 16. 1904.
On Pennisetum glaucum (L.) R. Br.: Georgia. Reported by Luttrell (Plant Disease Reporter 38: 511. 1954), but on the basis of the uredia Cummins considers it to be P. chaetochloae Arth.

PUCCINIA PENTSTEMONIS Pk. Bull. Torr. Bot. Club 12: 35. 1885.

Puccinia peridermiospora (Ell. et Tracy) Arth.: See P. SPARGANIOIDES Ell. et Barth.

Puccinia permagna Arth. et Holw.: See PROSPODIUM PERMAGNUM (Arth. e Holw.) Cumm.

PUCCINIA PHACELIAE Syd. et Holw. in Syd. Monogr. Ured. 1: 314. 1902.

Puccinia phakopsoroides Arth. et Mains: See ANGIOPSORA PHAKOPSOROIDES (Arth. et Mains) Mains

PUCCINIA PHRAGMITIS (Schum.) Koern. Hedwigia 15: 179. 1876.
Uredo phragmitis Schum. Enum. Pl. Saell. 2: 231. 1803. Telia present in the type specimen.

PUCCINIA PHYLLOSTACHYDIS Kusano Bull. Agric. College Tokyo 8: 38. 1908.
American records (Manual Rusts U. S. and Canada, p. 188. 1934) of the

occurrence of Puccinia melanocephala Syd. belong to this species.

PUCCINIA PHYSALIDIS Pk. Bot. Gaz. 4: 218. 1879.

PUCCINIA PHYSOSTEGIAE Pk. et G. W. Clint. in Pk. Ann. Report N. Y. State Mus. 29: 50. 1878.

PUCCINIA PIMPINELLAE (Strauss) Roehling Deutsch. Fl. ed. 2 III 3: 131. 1813.
Uredo pimpinellae Strauss Ann. Wett. Ges. 2: 102. 1810. Telia present in the type specimen.
Puccinia pimpinellae Mart. Fl. Mosq. ed. 2. p. 226. 1817.

PUCCINIA PINAROPAPPI Syd. Hedwigia 40 (Beibl.): 127. 1901.

PUCCINIA PIPERI Ricker Jour. Myc. 11: 114. 1905.

PUCCINIA PISTORICA Arth. Bull. Torr. Bot. Club 38: 372. 1911.

PUCCINIA PITCAIRNIAE Lagh. in Diet. et Lagh. Bull. Soc. Myc. France 11: 214. 1895.

PUCCINIA PITTIERIANA P. Henn. Hedwigia 43: 147. 1904.

Puccinia plucheae (Syd.) Arth. : See P. BIOCELLATA Vest.

PUCCINIA PLUMBARIA Pk. Bot. Gaz. 6: 228. 1881.

PUCCINIA POAE-NEMORALIS Otth Mitth. Naturf. Ges. Bern. 1870: 113. 1871.
Puccinia poae-sudeticae Jorstad Nyt. Mag. f Naturv. 7υ: 325. 1932.

Puccinia poae-sudeticae (West.) Jørstad: See P. POAE-NEMORALIS Otth

Puccinia poae-sudeticae Jørstad var. airae (Lagh.) Arth. : See P. DESCHAMPSIAE Arth.

PUCCINIA POARUM Niels. Bot. Tidsskr. III 2: 34. 1877.

PUCCINIA PODOPHYLLI Schw. Schr. Nat. Ges. Leipzig 1: 72. 1822.

**PUCCINIA POIKILOSPORA Cumm. Bull. Torr. Bot. Club 67: 69. 1940.
On Smilax jalapensis Schl., S. spinosa Mill. : Guatemala.

PUCCINIA POLEMONII Diet. et Holw. in Diet. Bot. Gaz. 18: 255. 1893.

PUCCINIA POLYGONI-ALPINI Cruch. et Mayor in Cruchet Herb. Boiss. II 8: 245. 1908.

PUCCINIA POLYGONI-AMPHIBII Pers. Syn. Meth. Fung. p. 227. 1801.
Arthur (Manual Rusts U. S. and Canada, p. 232-233. 1934) recognizes three varieties based on host differences and minor morphological details: P. polygoni-amphibii Pers. var. persicariae (Strauss) Arth.; P. polygoni-amphibii Pers. var. convolvuli (Alb. et Schw.) Arth.; and P. polygoni-amphibii Pers. var. tovariae Arth.

PUCCINIA POLYSORA Underw. Bull. Torr. Bot. Club 24: 86. 1897.

PUCCINIA POROMERA Holw. No. Amer. Ured. 1: 90. 1913.

PUCCINIA POROPHYLLI P. Henn. Hedwigia 39 (Beibl.): 153. 1900.

PUCCINIA PORPHYROGENITA Curt. ex Thuem. Myc. Univ. No. 545. 1876.

Puccinia porri (Sow.) Wint. : See P. ALLII Rud.

PUCCINIA POSADENSIS Sacc. et Trott. in Sacc. Syll. Fung. 21: 691. 1912.
Uredo kaernbachii P. Henn. Bot. Jahrb. 18 (Beibl. 44): 23. 1894.
See NOTE 1, p. 110.
Puccinia kaernbachii Arth. Bull. Torr. Bot. Club 46: 110. 1919.
See also Puccinia microspora Diet.

PUCCINIA PRAEALTA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 306. 1918.

PUCCINIA PRAEGRACILIS Arth. Bull. Torr. Bot. Club 34: 585. 1907.

PUCCINIA PRAEGRACILIS PRAEGRACILIS.
Aecidium graebnerianum P. Henn. Hedwigia 37: 273. 1898.
On Habenaria gracilis S. Wats., Agrostis churberiana Hitch. : British Columbia. The trinomial was set up by Savile Mycologia 43: 457. 1951.

PUCCINIA PRAEGRACILIS CONNERSII (Savile) Savile Mycologia 43: 458. 1951.
Puccinia connersii Savile Mycologia 42: 665. 1950.
On Habenaria dilatata A. Gray, Deschampsia atropurpurea (Wahl.) Scheel. : British Columbia.

PUCCINIA PRAEMORSA Diet. et Holw. in Holw. Bot. Gaz. 31: 332. 1901.

PUCCINIA PRIONOSCIADII Lindr. Medd. Stockh. Hogsk. Bot. Inst. 4 (9): 5. 1901.

PUCCINIA PROBA Jacks. et Holw. in Arth. Mycologia 10: 143. 1918.

Puccinia probabilis Arth. et Cumm. : See P. GENTIANAE (Strauss) Roehling

Puccinia procera Diet. et Holw. : See PUCCINIA RECONDITA Rob. ex Desm.

PUCCINIA PROSERPINACAE Farl. Proc. Amer. Acad. 18: 80. 1883.
Aecidium proserpinacae Berk. et Curt. in Berk. Grevillea 3: 60. 1874.
See NOTE 1, p. 110.

Puccinia prosopidis Bieberdorf, Mefferd et Blackmon: See RAVENELIA HOLWAYI Diet.

Puccinia prospera Arth. : See P. FARINACEA Long

Puccinia proximella Arth. : See P. ARTHURELLA Trott.

PUCCINIA PSEUDOCYMOPTERI Holw. No. Amer. Ured. 1: 91. 1913.

PUCCINIA PSIDII Wint. Hedwigia 23: 171. 1884.

*PUCCINIA PTARMICAE Karst. Bidr. Känned. Finl. Nat. Folk 31: 41. 1879.
On Achillea ptarmica L. : Quebec. Hylander, Jørstad, and Nannfeldt (loc. cit. p. 44) consider this a synonym of Puccinia cnici-oleracei Pers. ex Desm.

PUCCINIA PULSATILLAE Kalchb. Math. Term. Kozlem. 3: 307. 1865.

PUCCINIA PULVERULENTA Grev. Fl. Edinb., p. 432. 1824.
Uredo vagans var. epilobii-tetragoni DC. Fl. Fr. 2: 228. 1805.
See NOTE 1, p. 110.
Puccinia vagans Arth. Manual Rusts U. S. and Canada, p. 313. 1934.
Arthur (Manual Rusts U. S. and Canada, p. 313. 1934.) sets up under Puccinia vagans (DC.) Arth. two varieties, P. vagans epilobii-tetragoni (DC.) Arth. and P. vagans gayophyti (Billings) Arth., based on host differences primarily.

PUCCINIA PUNCTATA Lk. Mag. Ges. Nat. Freunde Berlin 7: 30. 1815.

PUCCINIA PUNCTATA Lk. var. TROGLODYTES (Lindr.) Arth. Manual Rusts U. S. and Canada, p. 260. 1934.

PUCCINIA PUNCTIFORMIS (Strauss) Roehling Deutsch. Fl. Ed. 2. III, 3: 132. 1813.
Uredo punctiformis Strauss Ann. Wett. Ges. 2: 103. 1810. The type of this species contains telia.
Puccinia obtegens Tul. Ann. Sci. Nat. IV 2: 87. 1854. Telia not described.

Puccinia punctiformis Diet. et Holw.: See P. LAPATHICOLA Hylander, Jørstad et Nannf.

PUCCINIA PUNCTOIDEA Syd. Monogr. Ured. 1: 182. 1902.

*PUCCINIA PURITANICA Cumm. Bull. Torr. Bot. Club 68: 45. 1941.
On Carex pennsylvanica Lam.: Massachusetts.

PUCCINIA PURPUREA Cke. Grevillea 5: 15. 1876.

PUCCINIA PYGMAEA Eriks. Fungi Paras. Scand. No. 449. 1895. See also P. ammophilina Mains

PUCCINIA PYROLAE Cke. Proc. Portl. Soc. Nat. Hist. 1: 183. 1862.

Puccinia ranunculi Blytt: See P. BLYTTIANA Lagh.

PUCCINIA RATA Jacks. et Holw. in Jacks. Bot. Gaz. 65: 303. 1918.

PUCCINIA RAUNKAERII Ferd. et Winge Bot. Tidsskr. 29: 8. 1908.

PUCCINIA RECEDENS Syd. Monogr. Ured. 1: 146. 1902.

PUCCINIA RECONDITA Rob. ex Desm. Bull. Soc. Bot. France 4: 798. 1857. See Cummins and Caldwell (Phytopath. 46: 81-82. 1956.) for a discussion of the nomenclature of this species.
Uredo rubigo-vera DC. Fl. Fr. 6: 83. 1815. See NOTE 1, p. 110.
Puccinia hordei Fckl. Jahrb. Nass. Ver. Nat. 27-28: 16. 1873. (non Otth, 1871.)
Puccinia rubigo-vera Wint. Rab. Krypt. Fl. 1: 217. 1881.
Under this binomial Arthur (Manual Rusts U. S. and Canada, p. 177. 1934.) sets up six "varieties", based on cultures and aecial hosts.
Puccinia procera Diet. et Holw. in Diet. Erythea 1: 249. 1893.
Puccinia cockerelliana Bethel ex Arth. Bull. Torr. Bot. Club 46: 113. 1919.
Puccinia rubigo-vera (DC.) Wint. f. sp. bromicola Mains Papers Mich. Acad. Sci., Arts and Letters 17: 345. 1933.
Puccinia hordei-murini Buchw. Ann. Mycol. 41: 308. 1943.
Puccinia bromi-maximi Guyot Uredineana 2: 50. 1946.
Puccinia bromicola Guyot Uredineana 2: 52. 1946.

PUCCINIA REDEMPTA Jacks. Mycologia 14: 107. 1922.

PUCCINIA REDFIELDIAE Tracy Jour. Myc. 7: 281. 1893.

**PUCCINIA REPENTINA Jacks. et Holw. in Jacks. Mycologia 23: 489. 1931.
On Arracacia bracteata Coult. et Rose: Guatemala.

PUCCINIA RETECTA Syd. Ann. Mycol. 1: 34. 1903.

PUCCINIA RHAETICA E. Fisch. Bull. Herb. Boiss. 7: 420. 1899.

PUCCINIA RIBIS DC. Fl. Fr. 2: 221. 1805.

Puccinia riparia Mains: See P. RIPULAE Mains

*PUCCINIA RIPULAE Mains Bull. Torr. Bot. Club 66: 620. 1939.
Puccinia riparia Mains Mich. Acad. Sci., Arts. Letters 22: 156. 1937. (Non Holw. 1904).
On Baccharis glutinosa Pers.: Texas

PUCCINIA ROMANZOFFIAE Jacks. Brooklyn Bot. Garden Mem. 1: 268. 1918.

PUCCINIA ROSENII Arth. Bull. Torr. Bot. Club 45: 144. 1918.

Puccinia rotundata Diet.: See P. NEOROTUNDATA Cumm.

PUCCINIA RUBEFACIENS Johans. Bot. Notiser 1886. 174. 1886.

PUCCINIA RUBICUNDA Holw. Ann. Mycol. 2: 392. 1904.

Puccinia rubigo-vera (DC.) Wint.: See P. RECONDITA Rob. ex Desm.

Puccinia rubricans Holw.: See P. SANGUINOLENTA P. Henn.

PUCCINIA RUDBECKIAE Barth. No. Amer. Ured. No. 2862. 1923.

Puccinia ruelliae (Berk. et Br.) Lagh.: See P. LATERIPES Berk. et Rav.

PUCCINIA RUELLIAE-BOURGAEI Diet. et Holw. in Holw. Bot. Gaz. 31: 329. 1901.
Segregated from P. lateripes Berk. et Rav. on morphological grounds.
On Ruellia bourgaei Hemsl., R. geminiflora H. B. K., R. hookeriana (Nees) Hemsl., R. inundata H. B. K., R. williamsii Leonard: El Salvador, Honduras, Mexico.

PUCCINIA RUFESCENS Diet. et Holw. in Diet. Bot. Gaz. 18: 253. 1893.

PUCCINIA RUSSA Arth. et Cumm. Ann. Mycol. 31: 44. 1933.

PUCCINIA RYDBERGII Garrett Mycologia 6: 251. 1914.

PUCCINIA SALVIICOLA Diet. et Holw. in Holw. Bot. Gaz. 24: 33. 1897.

PUCCINIA SANGUINOLENTA P. Henn. Hedwigia 35: 228. 1896.
Puccinia rubricans Holw. Jour. Myc. 10: 165. 1904.
The host is Heteropteris and not Myrica.

PUCCINIA SARACHAE Mayor Mem. Soc. Neuch. Sci. Nat. 5: 499. 1913.

Pcucinia scaber (Ell. et Ev.) Barth.: See P. SUBSTERILIS Ell. et Ev.

PUCCINIA SCANDICA Johans. Bot. Notiser 1886: 175. 1886.

PUCCINIA SCHEDONNARDI Kell. et Swing. Jour. Myc. 4: 95. 1888.

PUCCINIA SCHISTOCARPHAE Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 534. 1918.

PUCCINIA SCHNEIDERII Schroet. in Schneider Herb. Schles. Pilze No. 448. 1879.

PUCCINIA SCIRPI DC. Fl. Fr. 2: 223. 1805.

PUCCINIA SCLERIAE (Paz.) Arth. Mycologia 9: 75. 1917.

PUCCINIA SCLERIICOLA Arth. Bot. Gaz. 40: 204. 1905.

PUCCINIA SEMIINSCULPTA Arth. Bot. Gaz. 40: 204. 1905.

PUCCINIA SEMOTA Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 531. 1918.

PUCCINIA SENECIONICOLA Arth. Bot. Gaz. 40: 199. 1905.

PUCCINIA SENILIS Arth. Bull. Torr. Bot. Club 47: 470. 1920.

**PUCCINIA SEORSA Jacks. et Holw. in Jacks. Mycologia 24: 103. 1932.
On Piptocarpha chontalensis Baker: Guatemala.

PUCCINIA SEPTENTRIONALIS Juel Oefv. Sv. Vet.-Akad. Foerh. 52: 383. 1895.

PUCCINIA SERIPHIDII Fahrendorf Ann. Mycol. 39: 182. 1941.
On Artemisia tridentata Nutt.: U.S.A. (Segregated from P. absinthii (Hedw. f.) DC. (P. tanaceti DC.)

PUCCINIA SESSILIS Schneid. ex Schroet. Abh. Schles. Ges. 48: 19. 1870.

PUCCINIA SETARIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 28. 1897.

PUCCINIA SEYMERIAE Burr. Bot. Gaz. 9: 189. 1884.

PUCCINIA SEYMOURIANA Arth. Bot. Gaz. 34: 11. 1902.

PUCCINIA SHERARDIANA Koern. Hedwigia 16: 19. 1877.

PUCCINIA SIEVERSIAE Arth. Bull. Torr. Bot. Club 31: 3. 1904.

PUCCINIA SILPHII Schw. Trans. Amer. Phil. Soc. II 4: 296. 1832.

Puccinia simulans (Pk.) Barth.: See P. CRYPTANDRI Ell. et Barth.

PUCCINIA SMILACIS Schw. Schr. Nat. Ges. Leipzig 1: 72. 1822.
Aecidium apocyni Schw. Schr. Nat. Ges. Leipzig 1: 68. 1822.

PUCCINA SOLANI Schw. ex Berk. et Curt. Jour. Acad. Nat. Sci. Phil. II 2: 281. 1853.

Puccinia solanita Arth.: See P. CLAVIFORMIS Lagh.

*PUCCINIA SOLHEIMII Cumm. Ann. Mycol. 38: 338. 1940.
On Dodecatheon pauciflorum (Durand) Greene: Wyoming.

PUCCINIA SOLIDIPES Jacks. et Holw. in Arth. Amer. Jour. Bot. 5: 527. 1918.

PUCCINIA SORGHI Schw. Trans. Amer. Phil. Soc. II 4: 295. 1832.

PUCCINIA SPARGANIOIDES Ell. et Barth. Erythea 4: 2. 1896.
Uredo peridermiospora Ell. et Tracy Jour. Myc. 6:77. 1890. See NOTE 1, p. 110.
Puccinia peridermiospora Arth. Sci. II. 10: 565. 1899.

PUCCINIA SPATIOSA Kern Mycologia 9: 213. 1917.

**PUCCINIA SPEGAZZINIANA de T. in Sacc. Syll. Fung. 7: 644. 1888.
On Eleutheranthera ruderalis (Sw.) Sch. Bip.: El Salvador, Guatemala, Honduras.

PUCCINIA SPEGAZZINII deT. in Sacc. Syll. Fung. 7: 704. 1888.

Puccinia sphaeralceae Gäum.: See P. SPHAERALCEOIDES Cumm.

*PUCCINIA SPHAERALCEOIDES Cumm. Bull. Torr. Bot. Club 79: 224. 1952.
Puccinia sphaeralceae Gäum. Ber. Schweiz. Bot. Gesells. 57: 249. 1947. (Non Ell. et Ev., 1897.)
On Phymosia rivularis (Dougl.) Rydb., Sphaeralcea ambigua Gray, S. orcuttii Rose: California, Idaho.

PUCCINIA SPHAEROMERIAE Fahrendorf Ann. Mycol. 39: 182. 1941.
On Sphaeromeria capitata Nutt.: Wyoming. Segregated from P. absinthii (Hedw. f.) DC. (P. tanaceti DC.).

PUCCINIA SPHENICA Arth. Bull. Torr. Bot. Club 38: 371. 1911.

PUCCINIA SPLENDENS Vize Grevillea 7: 11. 1878.

PUCCINIA SPOROBOLI Arth. Bull. Iowa Agric. Coll. Dept. Bot. 1884: 159. 1884.

Puccinia stakmanii Presley: See P. CACABATA Arth. et Holw.

PUCCINIA STIPAE Arth. Bull. Iowa Agric. Coll. Dept. Bot. 1884: 160. 1884.

Puccinia striolata (Speg.) Arth.: See P. MACROPODA Speg.

PUCCINIA STRIIFORMIS West. Bull. Soc. Roy. Acad. Belge 21(2): 235. 1854. (as striaeformis).
Uredo glumarum Schmidt Allgem. Äkon.-Tech. Fl. 1: 27. 1827. See NOTE 1, p. 110.
Puccinia glumarum Eriks. et E. Henn. K. Landtbr.-Akad. Handl. o Tidskr. 33: 169. 1894. Zeitschr. f. Pflanzenkr. 4: 197. 1894.
The selection of the valid name for this species follows Hylander, Jørstad, and Nannfeldt (loc. cit. p. 75).

PUCCINIA STROMATICA Berk. et Curt. in Berk. Grevillea 3: 53. 1874.

PUCCINIA SUBANGULATA Holw. No. Amer. Ured. 1: 25. 1905.

**PUCCINIA SUBAQUILA Jacks. et Holw. in Jacks. Mycologia 24: 169. 1932.
On Wedelia acapulcensis H.B.K.: Guatemala, Honduras.

PUCCINIA SUBCIRCINATA Ell. et Ev. Jour. Myc. 3: 56. 1887.

PUCCINIA SUBCORONATA P. Henn. Hedwigia 34: 94. 1895.
Puccinia antioquiensis Mayor Mem. Soc. Neuch. Sci. Nat. 5: 473. 1913.

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PUCCINIA SUBSTERILIS Ell. et Ev. Bull. Torr. Bot. Club 22: 58. 1895.
Uromyces scaber Ell. et Ev. Jour. Myc. 6: 119. 1891. Based on uredia only. See NOTE 1, p. 110.
Puccinia scaber Barth. North Amer. Ured. No. 2560. 1921.

PUCCINIA SUBSTRIATA Ell. et Barth. Erythea 5: 47. 1897.
Puccinia paspalicola Arth. Manual Rusts U. S. and Canada, p. 127. 1934.
Puccinia tubulosa Arth. Amer. Jour. Bot. 5: 464. 1918. (ex parte).
See Cummins (Mycologia 34: 683-686. 1942) for a discussion of this species.

PUCCINIA SUBTILIPES Speg. Anal. Mus. Nac. Hist. Nat. Buenos Aires 31: 386. 1922.
On Leptochloa scabra Nees, L. virgata (L.) Beauv.: Central and South America, Mexico, West Indies.

PUCCINIA SUKSDORFII Ell. et Ev. Jour. Myc. 7: 130. 1892.

PUCCINIA SUPERFLUA Holw. Ann. Mycol. 2: 392. 1904.

PUCCINIA SUPERIOR Jacks. in Jacks. et Whetz. Trans. Brit. Myc. Soc. 13: 20. 1928.
Uredo superior Arth. Bull. Torr. Bot. Club 31: 5. 1904. See NOTE 1, p. 110.
Dicaeoma superius Arth. No. Amer. Flora 7: 351. 1920. Telia not described.

PUCCINIA SWERTIAE Wint. Rabh. Krypt.-Fl. 1: 205. 1881.

PUCCINIA SYMPHORICARPI Hark. Bull. Calif. Acad. 1: 35. 1884.

PUCCINIA TAGETICOLA Diet. et Holw. in Holw. Bot. Gaz. 24: 26. 1897.

PUCCINIA TANACETI DC. Fl. Fr. 2: 222. 1805.
Uredo absinthii Hedw. f. ex DC. in Poir. Lam. Encyc. Meth. Bot. 8: 245. 1808.
Puccinia absinthii DC. Fl. Fr. 5: 56. 1815.
The nomenclature of this species follows that set up by Hylander, Jørstad, and Nannfeldt (loc. cit. p. 75).

PUCCINIA TARDISSIMA Garrett Mycologia 6: 251. 1914.

PUCCINIA TENUIS Burr. Bot. Gaz. 9: 188. 1884.
Caeoma (Aecidium) tenue Schw. Trans. Amer. Phil. Soc. II. 4: 293. 1832. See NOTE 1, p. 110.

PUCCINIA TETRAMERII Seym. in Pringle Mex. Fungi No. 9. 1896.

*PUCCINIA THALIAE Diet. Hedwigia 38: 250. 1899.
Uredo cannae Wint. Hedwigia 23: 172. 1884. See NOTE 1, p. 110.
Puccinia cannae P. Henn. Hedwigia 41: 105. 1902.
On Canna indica L., Thalia geniculata L.: Florida.

*PUCCINIA THELYPODII Cumm. Mycologia 31: 170. 1939.
Puccinia lupinicola Gäum. Ber. Schweiz. Bot. Gesell. 57: 247. 1947.
On Thelypodium lasiophyllum (H. et A.) Greene: California. The host of P. lupinicola is probably T. lasiophyllum and not Lupinus benthami.

PUCCINIA THLASPEOS Schub. in Fic., Fl. Dresd. 2: 254. 1823.
Puccinia holboellii (Hornem.) Rostr. Medd. Groen. 3: 534. 1888.
We follow Hylander, Jørstad, and Nannfeldt (loc. cit. p. 76) in reducing P. holboellii to synonymy.

PUCCINIA TITHONIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 31. 1897.

PUCCINIA TOLIMENSIS Mayor Mem. Soc. Neuch. Sci. Nat. 5: 516. 1913.

PUCCINIA TOMIPARA Trel. Trans. Wis. Acad. Sci. 6: 127. 1885.
Segregated from the P. rubigo-vera (P. recondita Rob. ex Desm.) complex on the basis of multicellular teliospores.

**PUCCINIA TRACHYTELA Syd. Ann. Mycol. 24: 290. 1926.
On Tetrapteris seemanii Tr. et Planch.: Costa Rica.

PUCCINIA TRELEASIANA Paz. in Rabh.-Wint.-Paz. Fungi Eur. No. 3821. 1892.

Puccinia triannulata (Berk. et Curt.) Jacks.: See P. MIRIFICA Diet. et Holw.

Puccinia triniochloae (Arth. et Holw.) Barth.: See UREDO TRINIOCHLOAE Arth.

PUCCINIA TRIPSACI Diet. et Holw. in Holw. Bot. Gaz. 24: 27. 1897.

PUCCINIA TRIUMFETTAE Diet. et Holw. in Holw. Bot. Gaz. 24: 30. 1897.

PUCCINIA TRIXITIS Arth. Amer. Jour. Bot. 5: 534. 1918.
Uredo trixitis Kern et Kell. Jour. Myc. 13: 26. 1907. See NOTE 1, p. 110.

PUCCINIA TUMAMOCENSIS Arth. Bull. Torr. Bot. Club 42: 589. 1915.

PUCCINIA TUMIDIPES Pk. Bull. Torr. Bot. Club 12: 34. 1885.

PUCCINIA TURGIDIPES Jacks. Mycologia 14: 110. 1922.

Puccinia turrita Arth.: See P. PAZSCHKEI Diet. var. TRICUSPIDATAE Savile

PUCCINIA TURYUTENSIS Speg. Anal. Soc. Cien. Argent. 12: 70. 1881.
Puccinia cressae Lagh. Bol. Soc. Brot. 7: 131. 1889.
Lindquist (Bol. Soc. Argent. Bot. 5: 35-36. 1953.) points out that the host of P. turyutensis is Cressa and not Convolvulus as given by Spegazzini.

Puccinia uliginosa Juel: See P. CARICINA DC. var. ULIGINOSA (Juel) Jørstad

PUCCINIA UMBILICI Guep. ex Duby. Bot. Gall. 2: 890. 1830.

PUCCINIA UNICA Holw. in Arth. et Fromme Torreya 15: 263. 1915.

Puccinia unilateralis (Arth.) Cumm.: See POLIOMA UNILATERALIS (Arth.) J. W. Baxter et Cumm.

PUCCINIA URBANIANA P. Henn. Hedwigia 37: 278. 1898.

PUCCINIA VACUA Diet. et Holw. in Holw. Bot. Gaz. 24: 30. 1897.

PUCCINIA VAGA Jacks. Mycologia 14: 112. 1922.

Puccinia vagans (DC.) Arth.: See P. PULVERULENTA Grev.

PUCCINIA VALIDA Arth. Bull. Torr. Bot. Club 42: 591. 1915.

PUCCINIA VARIA Arth. Amer. Jour. Bot. 5: 487. 1918.

PUCCINIA VARIABILIS Grev. Scott. Crypt. Fl. pl. 75. 1824.

PUCCINIA VELATA Arth. Amer. Jour. Bot. 5: 472. 1918.
Uredo velata Ell. et Ev. Bull. Torr. Bot. Club 22: 435. 1895. See NOTE 1, p. 110.

PUCCINIA VERATRI Duby Bot. Gall. 2: 890. 1830.
Uredo veratri DC. in Lam. Encycl. 8: 224. 1808. See NOTE 1, p. 110.

PUCCINIA VERBESINAE Schw. Schr. Nat. Ges. Leipzig 1: 73. 1822.

PUCCINIA VERGRANDIS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 474. 1918.

PUCCINIA VERNONIAE Schw. Trans. Amer. Phil. Soc. II. 4: 296. 1832.

PUCCINIA VERONICARUM DC. Fl. Fr. 2: 594. 1805.

PUCCINIA VERSICOLOR Diet. et Holw. in Holw. Bot. Gaz. 24: 28. 1897.

PUCCINIA VERTISEPTA Tracy et Gall. Jour. Myc. 4: 21. 1888.

PUCCINIA VERTISEPTOIDES Cumm. Ann. Mycol. 38: 338. 1940.
On Salvia regla Cav., S. sessei Benth.: Mexico. Segregated from P. vertisepta Tracy et Gall.

*PUCCINIA VESICULOSA Schlecht. ex Ehr. in Nees v. Esenbeck Horae Phys. Berolin., p. 97. 1820.
On Anemone narcissiflora L. var. villosissima DC.: Unalaska.

PUCCINIA VEXANS Farl. Proc. Amer. Acad. Sci. 18: 82. 1883.

PUCCINIA VILFAE Arth. et Holw. Bull. Iowa Lab. Nat. Hist. 4: 388. 1898.

PUCCINIA VINCAE Berk. in Smith Engl. Fl. V. 2: 364. 1836.
Uredo vincae DC. Fl. Fr. 6: 70. 1815. See NOTE 1, p. 110.

PUCCINIA VIOLAE (Schum.) DC. Fl. Fr. 5: 62. 1815.
Uredo violae Schum. Enum. Plant. Saell. 2: 233. 1803. Telia present.

PUCCINIA VIRGATA Ell. et Ev. Proc. Acad. Nat. Sci. Phil. 1893: 154. 1893.

PUCCINIA VIRGAE-AUREAE (DC.) Lib. Pl. Crypt. Arduenn. IV, No. 393. 1837.
Usually erroneously cited as Puccinia virgaureae.

PUCCINIA VOLKARTIANA E. Fisch. Ured. Schweiz., p. 381. 1904.

PUCCINIA WALDSTEINIAE Curt. ex Pk. Ann. Report N. Y. State Mus. 25: 120. 1873.

**PUCCINIA WATTIANA Barcl. Jour. Asiatic Soc. Bengal 54: 109. 1890.
On Clematis dioica L.: Guatemala.

Puccinia wentii Gäum.: See P. GRINDELIAE Pk.

PUCCINIA WINDSORIAE Schw. Trans. Amer. Phil. Soc. II. 4: 295. 1832.

PUCCINIA WULFENIAE Diet. et Holw. in Diet. Erythea 3: 79. 1895.

PUCCINIA XANTHII Schw. Schr. Nat. Ges. Leipzig 1: 73. 1822.

PUCCINIA XANTHIIFOLIAE Ell. et Ev. Jour. Myc. 6: 120. 1891.

PUCCINIA YOSEMITANA Blasd. Univ. Calif. Publ. Bot. 7: 150. 1919.

PUCCINIA ZALUZANIAE Arth. Bot. Gaz. 40: 205. 1905.

Puccinia zeugitis (Arth. et Holw.) Barth.: See UREDO ZEUGITIS Arth. et Holw.

PUCCINIA ZEXMENIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 26. 1897.

PUCCINIA ZIZIAE Ell. et Ev. Bull. Torr. Bot. Club 22: 60. 1895.

Puccinia zorniae (Diet.) Barth.: See P. OFFUSCATA Arth.

PUCCINIASTRUM AGRIMONIAE (Diet.) Tranz. Scripta Bot. Hort. Univ. Imper. Petrop. 4: 301. 1895.
Caeoma (Uredo) agrimoniae Schw. Trans. Amer. Phil. Soc. II. 4: 291. 1832. See NOTE 1, p. 110.
Thecopsora agrimoniae Diet. Hedwigia 29: 153. 1890. Telia first described.

Pucciniastrum alaskanum Mains: See UREDO ALASKANA (Mains) Cumm.

PUCCINIASTRUM AMERICANUM (Farl.) Arth. Bull. Torr. Bot. Club 47: 468. 1920.

PUCCINIASTRUM ARCTICUM Tranz. Scripta Bot. Hort. Univ. Imper. Petrop. 4: 300. 1895.
Uredo arcticus Lagh. Hedwigia 28: 109. 1889. See NOTE 1, p. 110.
Peridermium ingenuum Arth. Phytopath. 8: 336. 1918.

PUCCINIASTRUM EPILOBII Otth Mith. Naturf. Ges. Bern 1861: 72 et 84. 1861.
Uredo pustulata Pers. Syn. Meth. Fung., p. 219. 1801. See NOTE 1, p. 110.
Pucciniastrum pustulatum Diet. in Engler et Prantl. Nat. Pflan. 1**: 47. 1897.

Pucciniastrum ericae (Naumann) Cumm.: See UREDO ERICAE Naumann

Pucciniastrum fuchsiae Hirat. f.: See UREDO FUCHSIAE Arth. et Holw.

Pucciniastrum galii (Lk.) E. Fisch.: See P. GUTTATUM (Schroet.) Hylander, Jørstad et Nannf.

PUCCINIASTRUM GOEPPERTIANUM (Kuehn) Kleb. Wirtsw. Rost. p. 391. 1904.
Calyptospora goeppertiana Kuehn Hedwigia 8: 81. 1869.

Pucciniastrum goodyerae (Tranz.) Arth.: See UREDO GOODYERAE Tranz.

PUCCINIASTRUM GUTTATUM (Schroet.) Hylander, Jørstad et Nannf. Opera Bot. 1: 81. 1953.
Caeoma galii Lk. in Willd. Sp. Pl. Ed. 4, 6(2): 21. 1825. See NOTE 1, p. 110.
Melampsora guttata Schroet. Abh. Schles. Ges. Vaterl. Cult. Nat. Abth. 1869-1872: 26. 1870.
Pucciniastrum galii E. Fisch. Beitr. Krypt.-Fl. Schweiz. 2 (2): 471. 1904.

PUCCINIASTRUM HYDRANGEAE (Magn.) Arth. Res. Sci. Congr. Bot. Vienne, p. 337. 1906.
Uredo hydrangeae Berk. et Curt. ex Seym. Bot. Gaz. 9: 191. 1884. See NOTE 1, p. 110.
Thecopsora hydrangeae Magn. in Vesterg. Micr. Rar. Sel. No. 571. 1902.

Pucciniastrum myrtilli (Schum.) Arth.: See P. VACCINII (Wint.) Jørstad

PUCCINIASTRUM POTENTILLAE Korn. in Jacz., Korn., et Tranz. Fungi Rossiae, No. 327. 1900.

Pucciniastrum pustulatum (Pers.) Diet.: See P. EPILOBII Otth

PUCCINIASTRUM PYROLAE Diet. ex Arth. No. Amer. Flora 7: 108. 1907.
Aecidium pyrolae Pers. ex J. F. Gmel. in L. Syst. Nat. Ed. 13, 2: 1473. 1791. Pre-starting point name for imperfect state only.
Thecopsora pyrolae Karst. Bidr. Finl. Nat. Folk 31: 59. 1879. Uredia only.
Pucciniastrum pirolae Schroet. Jahresber. Schles. Ges. Vaterl. Cult. 58: 167. 1880. Uredia only.

PUCCINIASTRUM SPARSUM (Wint.) E. Fisch. Beitr. Krypt. Schweiz II. 2: 469. 1904.

PUCCINIASTRUM VACCINII (Wint.) Jørstad Skr. Vidensk.-Akad. Oslo I. 1951 (2): 55. 1952.
Aecidium myrtilli Schum. Enum. Pl. Saell. 2: 227. 1803. See NOTE 1, p. 110.
Melampsora vaccinii Wint. Hedwigia 19: 56. 1880 (Telia not described). Rabh. Krypt.-Fl. Ed. 2, I, 1: 244. 1882.
Pucciniastrum myrtilli Arth. Rés. Sci. Congr. Bot. Vienne, p. 337. 1906. (Telia not described). No. Amer. Flora 7: 109. 1907.

Pucciniola: See UROMYCES

PUCCINIOSIRA BRICKELLIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 34. 1897.

**PUCCINIOSIRA EUPATORII Lagh. ex Arth. Amer. Jour. Bot. 5: 435. 1918.
On Eupatorium sp. : Guatemala, Honduras.

PUCCINIOSIRA PALLIDULA (Speg.) Lagh. Tromso Mus. Aarsh. 16: 122. 1894.

RAVENELIA ACACIAE-PENNATULAE Diet. Beih. Bot. Centralbl. 20: 373. 1906.

RAVENELIA ANNULATA Long Bot. Gaz. 61: 423. 1916.

**RAVENELIA ANTIGUANA Cumm. Bull. Torr. Bot. Club 67: 608. 1940.
On Cassia biflora L. : Guatemala.

RAVENELIA APPENDICULATA Tranz. ex Diet. Hedwigia 33: 369. 1894.

RAVENELIA ARIZONICA Ell. et Ev. Bull. Torr. Bot. Club 22: 363. 1895.

RAVENELIA ARTHURII Long Jour. Myc. 12: 234. 1906.
Ravenelia portoricensis Arth. Bull. Torr. Bot. Club 31: 5. 1904.
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RAVENELIA AUSTRALIS Diet. et Neg. Engler's Bot. Jahrb. 24: 161. 1897.

**RAVENELIA BIFENESTRATA Mains Carnegie Inst. Wash. Publ. 461: 97. 1935.
On Pithecolobium platylobum (Spreng.) Urban: Mexico.

RAVENELIA BIZONATA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 424. 1918.

RAVENELIA BRONGNIARTIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 35. 1897.

Ravenelia caesalpiniae Arth. : See LIPOCYSTIS CAESALPINIAE (Arth.) Cumm.

RAVENELIA CASSIAECOLA Atk. Bot. Gaz. 16: 313. 1891.

RAVENELIA CASSIAE-COVESII Long et Goodding in Long Bot. Gaz. 72: 42. 1921.

RAVENELIA CAULICOLA Arth. No. Amer. Flora 7: 143. 1907.

RAVENELIA CEBIL Speg. Anal. Mus. Nac. Buenos Aires 19: 295. 1909.

Ravenelia cubensis Arth. et J. R. Johnston: See UREDO CUBENSIS (Arth. et
J. R. Johnston) Cumm.

RAVENELIA DISTANS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 424. 1918.

*RAVENELIA DYSOCARPAE Long et Goodding Mycologia 31: 670. 1939.
On Mimosa dysocarpa Benth. : Arizona.

RAVENELIA ECTYPA Arth. et Holw. in Arth. Mycologia 10: 120. 1918.

RAVENELIA ENTADAE Lagh. et Diet. in Diet. Hedwigia 33: 62. 1894.

RAVENELIA EPIPHYLLA (Schw.) Diet. Hedwigia 33: 27. 1894.

RAVENELIA EXPANSA Diet. et Holw. in Holw. Bot. Gaz. 24: 35. 1897.

RAVENELIA FARLOWIANA Diet. Hedwigia 33: 369. 1894.
Dendroecia farlowiana Arth. Rés. Sci. Cong. Bot. Vienne, p. 340. 1906.

RAVENELIA FRAGRANS Long Bot. Gaz. 35: 123. 1903.

RAVENELIA GRACILIS Arth. Bot. Gaz. 39: 393. 1905.

RAVENELIA GOODDINGII Long Bot. Gaz. 72: 41. 1921.

RAVENELIA HAVANENSIS Arth. Bull. Torr. Bot. Club 48: 35. 1921.

RAVENELIA HIERONYMII Speg. Anal. Soc. Cien. Argent. 12: 66. 1881.
Cystingophora hieronymii Arth. No. Amer. Flora 7: 131. 1907.

Ravenelia hoffmanseggiae Long: See UREDO HOFFMANSEGGIAE (Long) Cumm.

RAVENELIA HOLWAYI Diet. Hedwigia 33: 61. 1894.
Neoravenelia holwayi Long Bot. Gaz. 35: 131. 1903.
Puccinia prosopidis Bieberdorf, Mefferd et Blackmon Bull. Torr. Bot. Club 82: 131. 1955. On the basis of material in the National Fungus Collections this appears to be Ravenelia holwayi, although no telial spores were found.

*RAVENELIA HUMPHREYANA P. Henn. Hedwigia 37: 278. 1898.
On Poinciana pulcherrima L. : Florida, Texas.

RAVENELIA IGUALICA Arth. No. Amer. Flora 7: 136. 1907.

RAVENELIA INCONSPICUA Arth. Bot. Gaz. 39: 395. 1905.

RAVENELIA INDICA Berk. Gard. Chron. 1853: 132. 1853.

*RAVENELIA INDIGOFERAE Tranz. ex Diet. Hedwigia 33: 369. 1894.
On Indigofera sphaerocarpa A. Gray : Arizona.

Ravenelia ingae (P. Henn.) Arth. : See CHACONIA INGAE (Syd.) Cumm.

Ravenelia inquirenda Arth. et Holw. : See UREDO ACACIAE-BURSARIAE Cumm.

RAVENELIA IRREGULARIS Arth. No. Amer. Flora 7: 142. 1907.

RAVENELIA LAEVIS Diet. et Holw. in Holw. Bot. Gaz. 24: 35. 1897.

RAVENELIA LEUCANAE Long Bot. Gaz. 35: 126. 1903.

RAVENELIA LEUCANAE-MICROPHYLLAE Diet. Beih. Bot. Centralbl. 20: 375. 1906.

RAVENELIA LONCHOCARPI Lagerh. et Diet. in Diet. Hedwigia 33: 46. 1894.
See also Uredo ierensis Dale.

RAVENELIA LYSILOMAE Arth. Bot. Gaz. 39: 392. 1905.

RAVENELIA MAINSIANA Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 426. 1918.

**RAVENELIA MERA Cumm. Bull. Torr. Bot. Club 70: 78. 1943.
(Published as R. mere in error.)
On Lonchocarpus michelianus Pittier, L. minimiflorus D. Smith, L. rugosus Benth. : Guatemala, Honduras, El Salvador.

RAVENELIA MESILLANA Ell. et Barth. in Ell. et Ev. Bull. Torr. Bot. Club 25: 508. 1898.

RAVENELIA MEXICANA Tranz. ex Diet. Hedwigia 33: 370. 1894.

RAVENELIA MIMOSAE-ALBIDAE Diet. Beih. Bot. Centralbl. 20: 378. 1906.

RAVENELIA MIMOSAE-COERULEAE Diet. Beih. Bot. Centralbl. 20: 378. 1906.

RAVENELIA MIMOSICOLA Arth. No. Amer. Flora 7: 137. 1907.

RAVENELIA MORONGIAE Long Bot. Gaz. 61: 418. 1916.

**RAVENELIA OLIGOTHELIS Speg. Anal. Mus. Nac. Buenos Aires 19: 296. 1909.
On Pithecolobium sophorocarpum Benth. : Costa Rica.

RAVENELIA OPACA Diet. Hedwigia 34: 291. 1895.
Dendroecia opaca Arth. No. Amer. Flora 7: 145. 1907.

RAVENELIA PAPILLIFERA Syd. Ann. Mycol. 1: 330. 1903.

RAVENELIA PISCIDIAE Long Jour. Myc. 12: 234. 1906.

RAVENELIA PITHECOLOBII Arth. Bot. Gaz. 39: 394. 1905.

Ravenelia portoricensis Arth. : See R. ARTHURII Long

RAVENELIA RETICULATAE Long Bot. Gaz. 61: 421. 1916.

RAVENELIA ROEMERIANAE Long Bot. Gaz. 64: 59. 1917.

RAVENELIA SIDEROCARPI Long Bot. Gaz. 64: 57. 1917.

Ravenelia siliquae Long: See RAVENELIA SPEGGAZZINIANA Lindquist

RAVENELIA SIMILIS (Long) Arth. Bot. Gaz. 39: 396. 1905.

RAVENELIA SOLOLENSIS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 425. 1918.

RAVENELIA SPEGAZZINIANA Lindquist Bol Soc. Argent. Bot. 1: 300. 1946.
Ravenelia siliquae Long Bot. Gaz. 35: 118. 1903. Telia not reported.

RAVENELIA SPINULOSA Diet. et Holw. in Holw. Bot. Gaz. 31: 336. 1901.

RAVENELIA STEVENSII Arth. Mycologia 7: 178. 1915.

RAVENELIA SUBTORTUOSAE Long Bot. Gaz. 72: 40. 1921.
Neoravenelia subtortuosae (Long) Arth. No. Amer. Flora 7: 704. 1925.

RAVENELIA TALPA (Long) Arth. Bot. Gaz. 39: 396. 1905.

RAVENELIA TEXENSIS Ell. et Gall. ex Diet. Hedwigia 33: 42. 1894.

RAVENELIA THORNBERIANA Long Bot. Gaz. 61: 420. 1916.

RAVENELIA VERRUCOSA Cke. et Ell. Grevillea 15: 112. 1887.

RAVENELIA VERSATILIS Diet. Hedwigia 33: 64. 1894.
Uromyces versatilis Pk. Bot. Gaz. 7: 56. 1882. Telia not described.

**ROESTELIA GUATEMALIANA (Crowell) Cumm. Mycologia 48: 606. 1956.
Gymnosporangium guatemalianum Crowell Canadian Jour. Bot. C 18: 11. 1940.
Telial state unknown.
On Amelanchier nervosa (Dcne.) Standl.: Guatemala.

SCOPELLA BAUHINIICOLA Cumm. Mycologia 48: 606. 1956.
Uredo bauhiniicola P. Henn. Hedwigia 34: 98. 1895. See NOTE 1, p. 110.
Scopella bauhiniicola Cumm. Bull. Torr. Bot. Club 67: 72. 1940.
Latin diagnosis not provided.

**SCOPELLA KEVORKIANII Cumm. Bull. Torr. Bot. Club 77: 206. 1950.
On Mimusops albescens (Benth.) Baill.: Cuba.

*SCOPELLA SAPOTAE Mains ex Cumm. Mycologia 48: 607. 1956.
Uredo sapotae Arth. et J.R. Johnston Mem. Torr. Bot. Club 17: 169. 1918.
See NOTE 1, p. 110.
Scopella sapotae Mains Ann. Mycol. 37: 59. 1939. Latin diagnosis
not provided.
On Achras sapota L.: Florida

SKIERKA CRISTATA Mains Mycologia 31: 182. 1939.
Uredo cristata Speg. Anal. Soc. Cien. Argent. 17: 119. 1884. See NOTE
1, p. 110.
Ctenoderma cristata (Speg.) Syd. Ann. Mycol. 17: 102. 1920.

SKIERKA HOLWAYI Arth. Amer. Jour. Bot. 5: 433. 1918.

SPHAEROPHRAGMIUM DALBERGIAE Diet. Hedwigia 32: 30. 1893.

**SPHAEROPHRAGMIUM FIMBRIATUM Mains Carnegie Inst. Wash. Publ. 461: 96. 1935.
On Dalbergia glabra (Mill.) Standl., Dalbergia sp.: Guatemala, Nicaragua.

**SPHENOSPORA KEVORKIANII Linder Mycologia 36: 464. 1944.
On Epidendron difforme Jacq., Oncidium sp., Schomburgkia sp., Sobralia sp., Stanhopea sp.: Nicaragua, Panama.

*SPHENOSPORA MERA Cumm. Bull. Torr. Bot. Club 72: 214. 1945.
On Bletilla striata Reichb. f., Bletilla sp.: Florida, Honduras.

SPHENOSPORA SMILACINA Syd. Ann. Mycol. 23: 318. 1925.
Uredo yurimaguasensis P. Henn. Hedwigia 43: 164. 1904. See NOTE 1, p. 110.
Sphenospora yurimaguasensis Jacks. Mycologia 18: 153. 1926.

Sphenospora yurimaguasensis (P. Henn.) Jacks.: See S. SMILACINA Syd.

Spirechina arthuri (Syd.) Arth.: See KUEHNEOLA ARTHURI (Syd.) Jacks.

Spirechina epiphylla Arth.: See MAINSIA EPIPHYLLA (Arth.) Jacks.

Spirechina loeseneriana (P. Henn.) Arth.: See KUEHNEOLA LOESENERIANA (Arth.)
Jacks. et Holw.

Spirechina pittieriana (P. Henn.) Arth.: See MAINSIA PITTIERIANA (P. Henn.) Jacks.

Spirechina rubi (Diet. et Holw.) Arth.: See MAINSIA RUBI (Diet. et Holw.) Jacks.

**SPUMULA QUADRIFIDA Mains Mycologia 27: 638. 1935.
On Calliandra bijuga Rose: Mexico.

Synomyces reichei (Diet.) Arth.: See COLEOSPORIUM REICHII Diet.

**TEGILLUM FIMBRIATUM Mains Bull. Torr. Bot. Club 67: 707. 1940.
On Vitex sp.: British Honduras.

Teleutospora: See UROMYCES

TRACHYSPORA INTRUSA (Grev.) Arth. Manual Rusts U. S. and Canada, p. 97. 1934.
Uredo intrusa Grev. Fl. Edin., p. 436. 1824. Telia described.

TRANZSCHELIA ANEMONES (Pers.) Nannf. in Lundell et Nannfeldt Fungi Exs. Suec. No. 839a. 1939.

Hylander, Jørstad, and Nannfeldt (loc. cit. p. 84) place T. fusca (Pers.) Diet., T. suffusca (Holw.) Arth. and T. thalictri (Chev.) Diet. in synonymy with T. anemones.

TRANZSCHELIA ARTHURI Tranz. et Litv. Jour. de Bot. 24: 250. 1939.
On Prunus serotina: North America. Segregated from T. pruni-spinosae, but not yet studied in this country for validity.

TRANZSCHELIA COHAESA (Long) Arth. Rés. Sci. Congr. Bot. Vienne, p. 340. 1906.

TRANZSCHELIA DISCOLOR (Fckl.) Tranz. et Litv. Jour. de Bot. 24: 248. 1939.
Tranzschelia pruni-spinosae (Pers.) Diet. var. discolor Dunegan Phytopath. 28: 424. 1938.

On Prunus spp. (cultivated forms) throughout the world. Segregated from T. pruni-spinosae (Pers.) Diet.

TRANZSCHELIA FUSCA Diet. Ann. Myc. 20: 31. 1922.
Aecidium fuscum Pers. ex G. F. Gmel. in L. Syst. Nat. Ed. 13, 2: 1473. 1791. Contains telia, but is pre-starting point.
See also T. anemones (Pers.) Nannf.

TRANZSCHELIA PRUNI-SPINOSAE (Pers.) Diet. Ann. Myc. 20: 212. 1922.

TRANZSCHELIA PRUNI-SPINOSAE (Pers.) Diet. var. TYPICA (E. Fisch.) Dunegan Phytopath. 28: 423. 1938.

Under a strict interpretation of the code, this becomes T. pruni-spinosae (Pers.) Diet. var. pruni-spinosae.

Tranzschelia pruni-spinosae (Pers.) Diet. var. discolor (E. Fisch.) Dunegan: See T. DISCOLOR (Fckl.) Tranz. et Litv.

TRANZSCHELIA SUFFUSCA (Holw.) Arth. Manual Rusts U. S. and Canada, p. 73. 1934.
See also T. anemones (Pers.) Nannf.

TRANZSCHELIA THALICTRI (Chev.) Diet. Ann. Mycol. 20: 31. 1922.
See also T. anemones (Pers.) Nannf.

TRANZSCHELIA TUCSONENSIS (Arth.) Diet. Ann. Myc. 20: 31. 1922.
Lipospora tucsonensis Arth. Bull. Torr. Bot. Club 48: 36. 1921.

TRANZSCHELIA VIORNAE (Arth.) Arth. Manual Rusts U. S. and Canada, p. 74. 1934.

Tricella acuminata Long: See PHRAGMOPYXIS ACUMINATA (Long) Syd.

TRIPHRAGMIUM ULMARIAE (DC.) Lk. in Willd. Sp. Plant. 6 (2): 84. 1825.
Puccinia ulmariae Hedw. f. ex DC. in Poir. in Lam. Encyc. Méth. Bot. 8: 245. 1808. DC. Fl. Fr. 5: 56. 1815.

URAECIUM EXTENSUM (Arth.) Cumm. Mycologia 48: 607. 1956.
Pileolaria extensa Arth. No. Amer. Flora 7: 148. 1907. Telia not reported.

URAECIUM HOLWAYI (Arth.) Arth. Bull. Torr. Bot. Club 60: 476. 1933.

Uraecium lucumae (Arth. et J. R. Johnston) Arth.: See ACHROTELIUM LUCUMAE Arth.

UREDINOPSIS

The treatment of this genus in Arthur's Manual was completely reworked by J. H. Faull in his comprehensive study "Taxonomy and Geographical Distribution of the Genus Uredinopsis" published as Contribution from the Arnold Arboretum 11, 1938. Several species were divided, others added, and many new hosts and distribution records added. For details not given in the listings hereafter see Faull's monograph.

UREDINOPSIS AMERICANA Syd. Ann. Mycol. 1: 325. 1903.
Septoria mirabilis Pk. Ann. Report N.Y. State Mus. 25: 87. 1873.
See NOTE 1, p. 110.
Uredinopsis mirabilis Magn. Hedwigia 43: 121. 1904.
Segregated from U. mirabilis (Pk.) Magn. (pro parte) of the "Manual."

UREDINOPSIS ARTHURII Faull Contrib. Arnold Arbor. 11: 101-102. 1938.
On Woodwardia virginica (L.) Sm. Segregated from U. struthiopteridis Stoermer. of the "Manual."

UREDINOPSIS ARTHURII Faull var. MACULATA Faull Contrib. Arnold Arbor. 11: 103-104. 1938.
On Woodwardia areolata (L.) Moore. Segregated from U. mirabilis (Pk.) Magn of the "Manual."

UREDINOPSIS ASPERA Faull Contrib. Arnold Arbor. 11: 79-80. 1938.
On Pteridium aquilinum (L.) Kuehn var. lanuginosa (Bong.) Fernald. Segregated from U. macrosperma (Cke.) Magn. of the "Manual."

UREDINOPSIS ATKINSONII Magn. Hedwigia 43: 123. 1904.
On Abies balsamea (L.) Mill., Dryopteris thelypteris var. pubescens (Lawson) A.R.Prince: U.S.A., and Canada. Reinstated from U. struthiopteridis Stoermer of the "Manual."

UREDINOPSIS CERATOPHORA Faull Contrib. Arnold Arbor. III: 52-53. 1938.
On Abies balsamea (L.) Mill., Cystopteris bulbifera (L.) Bernh.: Indiana, New York, Wisconsin, Ontario. Segregated from U. struthiopteridis Stoermer of the "Manual."

UREDINOPSIS COPELANDII Syd. Ann. Mycol. 2: 30. 1904.
On Athyrium cyclosorum Rupr.: California. Reinstated from U. struthiopteridis Stoermer of the "Manual" by Faull (loc. cit. p. 39).

*UREDINOPSIS GLABRA Faull Contrib. Arnold Arbor. 11: 55-56. 1938.
On Chilanthes pyramidalis Fee, Cystopteris fragilis (L.) Bernh., Pellaea cordata (Cav.) J. Sm.: New Mexico, Mexico.

Uredinopsis investita Faull: See UREDO INVESTITA (Faull) Cumm.

UREDINOPSIS LONGIMUCRONATA Faull Contrib. Arnold Arbor. 11: 44. 1938.
Segrated from U. struthiopteridis Stoermer ex parte. Faull also sets up U. longimucronata forma cyclosora (loc. cit. p. 48).

UREDINOPSIS LONGIMUCRONATA var. ACROSTICHOIDES Faull Contrib. Arnold Arbor. 11: 50. 1938.
On Athyrium thelypteroides (Michx.) Desv.: New Hampshire, New York, Wisconsin.

Uredinopsis macrosperma (Cke.) Magn.: See U. PTERIDIS Diet. et Holw.

Uredinopsis mirabilis (Pk.) Magn.: See U. AMERICANA Syd.

UREDINOPSIS OSMUNDAE Magn. Hedwigia 43: 123. 1904.

UREDINOPSIS PHEGOPTERIDIS Arth. No. Amer. Flora 7: 117. 1907.

UREDINOPSIS PTERIDIS Diet. et Holw. in Diet. Ber. Deutsch. Bot. Ges. 13: 331. 1895.
Uredo macrospermum Cke. Grevillea 8: 71. 1879. See NOTE 1, p. 110.
Uredinopsis macrosperma Magn. Hedwigia 43: 122. 1904.

UREDINOPSIS STRUTHIOPTERIDIS Stoermer ex Diet. Ber. Deutsch. Bot. Ges. 13: 331. 1895.
Uredinopsis struthiopteridis Stoermer Bot. Notiser, p. 81. 1895.
Telia not described.

UREDINOPSIS VIRGINIANA Faull Contrib. Arnold Arbor. 11: 92. 1938.
On Pteridium aquilinum var. pseudocaudatum Clute: Eastern and Central U. S.
Included in U. macrosperma (Cke.) Magn. (U. pteridis Diet. et Holw.) in the Manual.

UREDO ACACIAE-BURSARIAE Cumm. Mycologia 48: 607. 1956.
Ravenelia inquirenda Arth. et Holw. Amer. Jour. Bot. 5: 423. 1918.
Telia not described. Non Uredo inquirenda Arth. (Bull. Torr. Bot. Club 34: 592. 1907.) which applies to another rust and cannot be taken up for the species involved here.

UREDO ADENOCAULONIS (Jacks.) Cumm. Mycologia 48: 607. 1956.
Coleosporium adenocaulonis Jacks. Brooklyn Bot. Garden Mem. 1: 202. 1918. Based on uredia.

UREDO AESCHYNOMENIS Arth. Bot. Gaz. 39: 392. 1905.
Phakopsora aeschynomenis Arth. Bull. Torr. Bot. Club 44: 509. 1917.
Telia unknown.

*UREDO ALASKANA (Mains) Cumm. Mycologia 48: 607. 1956.
Pucciniastrum alaskanum Mains Bull. Torr. Bot. Club 66: 620. 1939.
Based on uredia.
On Gentiana glauca Pall.: Alaska.

UREDO AMICOSA Arth. Bull. Torr. Bot. Club 46: 121. 1919.

**UREDO ANACARDII Mains Carnegie Inst. Wash. Publ. 461: 104. 1935.
On Anacardium occidentale L.: Guatemala.

Uredo antiguensis Cumm.: See PHAKOPSORA ANTIGUENSIS Kern et Thurston

UREDO ANTHURII (Hariot) Sacc. Syll. Fung. 11: 229. 1895.

UREDO ARIDA (Jacks. in Arth.) Cumm. Mycologia 48: 607. 1956.
Coleosporium aridum Jacks. in Arth. Bull. Torr. Bot. Club 51: 52. 1924. Based on uredia.

UREDO ARTOCARPI Berk. et Br. Jour. Linn. Soc. 14: 93. 1873.
Physopella artocarpi Arth. No. Amer. Flora 7: 103. 1907. Telia unknown.

UREDO ARUNDINELLAE Arth. et Holw. in Arth. Mycologia 10: 148. 1918.
Puccinia arundinellae Barth. Handbook No. Amer. Ured. Ed. 1, p. 88. 1928. Telia unknown.

Uredo bauhiniicola P. Henn.: See SCOPELLA BAUHNINIICOLA Cumm.

UREDO BEHNICKIANA P. Henn. Hedwigia 44: 169. 1905.

Uredo biporula Arth. : See PUCCINIA BIPORULA J. W. Baxter

UREDO BIXAE Arth. Mycologia 7: 327. 1915.

UREDO BORRERIAE (P. Henn.) Kern et Whetz. Mycologia 18: 42. 1926.

UREDO BUCHENAVIAE Kern et Whetz. Mycologia 18: 40. 1926.

**UREDO BULLULA Kern Mycologia 20: 77. 1928.
On Eupatorium sp. : Dominican Republic.

UREDO CAMPELIAE Kern et Whetz. Mycologia 18: 40. Feb. 1926.
Uredo campeliae Syd. Ann. Mycol. 24: 294. Dec. 1926.
On Campelia zanonia (L.) H. B. K. : Costa Rica, Nicaragua, Puerto Rico.

UREDO CEPHALANTHI Arth. Bull. Torr. Bot. Club 29: 231. 1902.

Uredo cherimoliae Lagh. : See PHAKOPSORA CHERIMOLIAE Cumm.

UREDO CLUSIAE Arth. Mycologia 9: 91. 1917.

UREDO COCCOLOBAE P. Henn. Hedwigia 35: 253. 1896.

**UREDO COLUBRINAE Cumm. Bull. Torr. Bot. Club 70: 79. 1943.
On Colubrina ferruginosa Brongn. : Guatemala.

Uredo commelyneae Kalchbr. : See PHAKOPSORA TECTA Jacks. et Holw.

UREDO CONSIMILIS (Arth.) Cumm. Mycologia 48: 607. 1956.
Milesia consimilis Arth. Mycologia 7: 176. 1915. Based on uredia.

UREDO CONTRARIA Arth. Bull. Torr. Bot. Club 47: 472. 1920.

UREDO CUBENSIS (Arth. et J. R. Johnston) Cumm. Mycologia 48: 607. 1956.
Ravenelia cubensis Arth. et J. R. Johnston Mem. Torr. Bot. Club 17: 118. 1918. Based on uredia.

Uredo cumula Arth. : See PUCCINIA BUCHNERAE Cumm.

UREDO CUPHEAE P. Henn. Hedwigia 34: 99. 1895.

UREDO CURVATA Arth. Bull. Torr. Bot. Club 49: 195. 1922.

UREDO CYATHULAE Mayor Mem. Soc. Neuch. Sci. Nat. 5: 584. 1913.

Uredo degener (Mains et Holw.) Arth. : See PUCCINIA DEGENER Mains et Holw.

**UREDO DETECTA Mains Contrib. Univ. Mich. Herb. 1: 16. 1939.
On Arrabidaea floribunda (H. B. K.) Loes. : British Honduras.

UREDO DIOSCOREAE P. Henn. Hedwigia 35: 255. 1896.
Records of this species in No. Amer. Flora (7: 606. 1924.) should all be transferred to U. dioscoreicola.

UREDO DIOSCOREICOLA Kern, Cif. et Thurston Ann. Mycol. 31: 24. 1933.
Uredo dioscoreae apud No. Amer. Flora 7: 606. 1924. (Non P. Henn. 1896).

UREDO EGENULA Arth. Bull. Torr. Bot. Club 45: 155. 1918.
Puccinia egenula Barth. Handbook No. Amer. Ured. Ed. 1, p. 108. 1933. Telia unknown.

**UREDO EICHHORNIAE Gonz.-Frag. et Cif. Bol. R. Soc. Esp. Hist. Nat. 27: 69. 1927.
On Eichhornia crassipes (Mart.) Solms.: Dominican Republic.

*UREDO EPIDENDRI P. Henn. Hedwigia 35: 254. 1896.
On Oncidium lieboldii Reichb. : Florida, Honduras, Mexico (on material intercepted by Plant Quarantine Service).

*UREDO ERICAE Naumann Jahresb. Vereinig. Angew. Bot. 9: 207. 1912.
Pucciniastrum ericae Cumm. Mycologia 27: 613. 1935. Telia unknown.
On Erica hyemalis Nichols: California.

**UREDO ERYTHRINAE P. Henn. Fl. Bas.-et Moyen-Congo in Ann. Mus. Congo 2 (3): 224. 1908.
On Erythrina berteroana Urban: Guatemala.

Uredo erythroxylonis Graz.: See BUBAKIA ERYTHROXYLONIS Cumm.

**UREDO FARINOSA P. Henn. Hedwigia 36: 216. 1897.
On Ocotea leucoxylon (Sw.) Mez.: Puerto Rico.

UREDO FICINA Juel Bih. Sv. Vet. Akad. Handl. 23 (3): 25. 1897.
Physopella ficina Arth. No. Amer. Flora 7: 103. 1907. Segregated from Cerotelium fici (Butl.) Arth. as distinct.

UREDO FLORIDANA Syd. Hedwigia 40 (Beibl.): 129. 1901.

UREDO FUCHSIAE Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 538. 1918.
Pucciniastrum fuchsiae Hirat. f. Jour. Fac. Agr. Hokkaido Imper. Univ. 21: 98. 1929. Telia unknown.

UREDO GAILLARDIAE Diet. et Holw. in Diet. Erythea 7: 98. 1899.
Puccinia gaillardiae Barth. Handbook No. Amer. Ured. Ed. 1, p. 115. 1928.
This species could be referred to the form genus Uraecium.

UREDO GARCILASSAE P. Henn. Hedwigia 43: 160. 1904.

**UREDO GEOPHILICOLA P. Henn. Hedwigia 43: 161. 1904.
On Geophila herbacea (Jacq.) Schum.: British Honduras.

UREDO GOODYERAE Tranz. Trudi S. Petersb. Obschch. Est. Otd. Bot. 23: 28. 1893.
Pucciniastrum goodyerae Arth. No. Amer. Flora 7: 105. 1907. Telia unknown.

UREDO GUACAE Mayor Mem. Soc. Neuch. Sci. Nat. 5: 583. 1913.
On Epidendrum nocturnum Jacq., E. tampense Lindl.: Florida. Also commonly intercepted by Plant Quarantine Inspectors on various orchids.

**UREDO GUAYNABENSIS Kern et Whetz. Mycologia 18: 41. 1926.
On Jussiaea angustifolia Lam., J. peruviana L.: Florida, Isle of Pines, Jamaica, Puerto Rico.

UREDO GYNANDREARUM Cda. Icon. Fung. 3: 3. 1839.

UREDO HAMELIAE Arth. Mycologia 8: 23. 1916.

UREDO HOFFMANSEGGIAE (Long) Cumm. Mycologia 48: 608. 1956.
Ravenelia hoffmanseggiae Long Bot. Gaz. 64: 57. 1917. Telia unknown.

UREDO HYMENAEAE Mayor Mem. Soc. Neuch. Sci. Nat. 5: 585. 1913.

UREDO HYPOXIDIS P. Henn. Hedwigia 40 (Beibl.): 173. 1901.
Segregated from Uromyces affinis Wint. (q.v.)

UREDO IERENSIS Dale Commonwealth Myc. Inst. Myc. Papers 59: 8. 1955.
On Lonchocarpus latifolius H. B. K. : Cuba, Guatemala; Lonchocarpus salvadorensis Pittier: El Salvador. Segregated from Ravenelia lonchocarpi Lagh.

UREDO IGNAVA Arth. Bull. Torr. Bot. Club 46: 121. 1919.
Puccinia ignava Arth. Mycologia 14: 17. 1922. Telia unknown

UREDO INCOMPOSITA Kern Mycologia 11: 143. 1919.
Puccinia incomposita Barth. Handbook No. Amer. Ured. Ed. 1, p. 127. 1928. Telia unknown.

UREDO INGAE P. Henn. Hedwigia 38 (Beibl.): 69. 1899.
Mains (Mycologia 31: 33-42. 1939.) considers that this is probably distinct from Chaconia (Bitzea) ingae (Syd.) Cumm. (q. v.).

UREDO INVESTITA (Faull) Cumm. Mycologia 48: 608. 1956.
Uredinopsis investita Faull Contrib. Arnold Arbor. 11: 35-36. 1938. Telia unknown.

Uredo jatrophicola Arth. : See PHAKOPSORA JATROPHICOLA Cumm.

UREDO JUCUNDA Syd. Ann. Mycol. 23: 324. 1925.

UREDO KYLLINGIAE P. Henn. Hedwigia 35: 256. 1896.
Segregated from Puccinia cyperi Arth.

*UREDO LAETICOLOR Arth. Bull. Torr. Bot. Club 47: 473. 1920.
On Ipomoea dissecta Jacq. : Florida.

UREDO LICANIAE P. Henn. Hedwigia 34: 99. 1895.

Uredo lucumae Arth. et J. R. Johnston: See ACHROTELIUM LUCUMAE Cumm.

UREDO LUTEA Arth. Mycologia 7: 321. 1915.

**UREDO MACHAERIICOLA Cumm. Bull. Torr. Bot. Club 70: 79. 1943.
On Machaerium biovulatum Mich. : Guatemala.

UREDO MACULANS Pat. et Gaill. Bull. Soc. Myc. France 4: 98. 1888.

**UREDO MARTYNII Dale Commonwealth Myc. Inst. Myc. Paper 60: 14. 1955.
On Isachne arundinacea Griseb. : Jamaica.

UREDO MAURIAE Syd. Ann. Mycol. 23: 325. 1925.
Uredo roupalae Cumm. Bull. Torr. Bot. Club 64: 43. 1937.
The host is Mauria and not Roupala.
On Mauria glauca D. Sm. : Costa Rica.

*UREDO MCKINLEYENSIS Cumm. Bull. Torr. Bot. Club 79: 231. 1952.
On Salix reticulata var. gigantifolia Ball: Alaska.

UREDO MEXICANA (Arth.) Cumm. Mycologia 48: 608. 1956.
Pileolaria mexicana Arth. No. Amer. Flora 7: 149. 1907. Telia unknown.

**UREDO MONOCHAETII Kern et Thurston Mycologia 36: 63. 1944.
On Heterocentron axillare Naud., H. salvadoranum Gleason: Guatemala, El Salvador.

**UREDO MONSTERAE Syd. Ann. Mycol. 28: 51. 1930.
On Philodendron sp. : Mexico (intercepted by Plant Quarantine Service).

**URERDO MUHLENBECKIAE Jacks. et Holw. in Jacks. Mycologia 19: 62. 1927.
On Muhlenbeckia tamnifolia Meissn. : Guatemala.

UREDO NEOPUSTULATA Cumm. Mycologia 48: 608. 1956.
Uredo pustulata P. Henn. Hedwigia 35 (Beibl.) : 129. 1899. (Non Pers. 1801.).

UREDO NICOTIANAE Anas., Sacc. et Splendore in Anas. et Splendore Boll. Tecn. Tabac. Ist. Scafati 3: 53. 1904.

UREDO NIBULARII P. Henn. Hedwigia 37: 206. 1898.
On Tillandsia sp. : Mexico (intercepted by Plant Quarantine Service).

*UREDO NIGROPUNCTA P. Henn. Hedwigia 35: 254. 1896.
On Cyrtopodium punctatum Lindl., Polystachya minuta Britt. : California, Florida.

*UREDO NOCIVIOLA Jacks. et Holw. in Jacks. Mycologia 18: 144. 1926
On Cyperus ferax Rich. : Grenada, Florida.

UREDO NOMINATA Arth. Bull. Torr. Bot. Club 49: 194. 1922.

**UREDO OBNIXA Cumm. Bull. Torr. Bot. Club 70: 80. 1943.
On Cyperus melanostachyus H. B. K. : Guatemala.

UREDO OBOVATA (Arth.) Cumm. Mycologia 48: 608. 1956.
Desmella obovata Arth. Mycologia 21: 78. 1929. Telia unknown.
Hyalopsora obovata Cumm. Ann. Mycol. 38: 336. 1940. Telia unknown.

*UREDO ONCIDII P. Henn. Hedwigia 41: 15. 1902.
On Oncidium bicallosum Lindl., O. cebolleta Sw., O. lanceanum Lindl. : California (in greenhouse); Guatemala, Mexico (Intercepted by Plant Quarantine Service).

**UREDO ORNITHIDII Kern, Cif. et Thurston Ann. Mycol. 31: 25. 1933.
On Ornithidium coccineum (Jacq.) Salisb. : Dominican Republic.

UREDO PANAMENSIS Arth. Bull. Torr. Bot. Club 45: 155. 1918.

UREDO PARONYCHIAE Jacks. in Arth. No. Amer. Flora 7: 610. 1924.

Uredo paspalicola P. Henn. : See ANGIOPSORA COMPRESSA Mains

UREDO PERIBEBUYENSIS Speg. Anal. Soc. Cien. Argent. 17: 123. 1884.

UREDO PHORADENDRI Jacks. Brooklyn Bot. Garden Mem. 1: 285. 1918.

UREDO PIPERIS P. Henn. Hedwigia 38 (Beibl.) : 70. 1899.

UREDO PISCARIAE (Jacks.) Cumm. Mycologia 48: 608. 1956.
Melampsora piscariae Jacks. Brooklyn Bot. Garden Mem. 1: 212. 1918. Based on uredia.

**UREDO POLYTAENII Kern, Cif. et Thurston Ann. Mycol. 31: 26. 1933.
On Polytaenium feei (Schaffn.) Maxon: Dominican Republic.

UREDO POSITA J. J. Davis ex Arth. Torreya 34: 46. 1934.

Uredo pustulata P. Henn.: See U. NEOPUSTULATA Cumm.

**UREDO QUICHENSIS Cumm. Bull. Tor. Bot. Club 70: 80. 1943.
On Calliandra conzattiana (Britt. et Rose) Standl. : Guatemala

UREDO RAMONENSIS Syd. Ann. Mycol. 23: 325. 1925.

UREDO RECONDITA Speg. Bol. Acad. Cien. Cordoba 23: 186. 1919.

UREDO REICHEANA Arth. No. Amer. Flora 7: 617. 1924.

UREDO RONDELETIAE Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 539. 1918.

Uredo roupalae Cumm. : See U. MAURIAE Syd.

UREDO ROUSSELIAE Kern et Whet. Mycologia 18: 40-41. 1926.

UREDO RUBESCENS Arth. Mycologia 7: 327. 1915.

UREDO SABICEICOLA Arth. Mycologia 7: 323-324. 1915.

Uredo saphena Arth. et Cumm. : See PUCCINIA MACROPODA Speg.

Uredo sapotae Arth. et J. R. Johnston: See SCOPELLA SAPOTAE Mains

UREDO SAUVAGESIAE Arth. Mycologia 8: 23. 1916.

UREDO SAVIAE Arth. et J. R. Johnston Mem. Bull. Torr. Bot. Club 17: 168. 1918.

**UREDO SCABIES Cke. Grevillea 15: 18. 1886.
On Vanilla pfaviana Reichb. f. and Vanilla sp. : Mexico, Nicaragua, Panama (intercepted by the Plant Quarantine Service).

UREDO SPARGANOPHORI P. Henn. Hedwigia 43: 160. 1904.

UREDO SPHACELICOLA Diet. et Holw. in Diet. Erythea 1: 248. 1893.

UREDO SPIGELIAE (Arth.) Cumm. Mycologia 48: 608. 1956.
Coleosporium spigeliae Arth. Bull. Torr. Bot. Club 51: 51. 1924.
Telia unknown.

UREDO SPIROSTACHYDIS Arth. Bull. Torr. Bot. Club 37: 576. 1910.

**UREDO STENOCHLAENAE Cumm. Bull. Torr. Bot. Club 79: 232. 1952.
On Stenochlaena vestita (Fourn.) Underw. : Honduras.

UREDO SUSPECTA Jacks. et Holw. in Arth. Mycologia 10: 150. 1918.

**UREDO TOROIANA Kern Mycologia 20: 76. 1928.
On Vernonia cinerea L. : Dominican Republic.

UREDO TRICHELIAE Arth. Mycologia 9: 90. 1917.

**UREDO TRIGONIAE Mains Contrib. Univ. Mich. Herb. 1: 17. 1939.
On Trigonia floribunda Oerst. : British Honduras.

UREDO TRINIOCHLOAE Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 538. 1918
Puccinia triniochloae Barth. Handbook No. Amer. Ured. Ed. 1, p. 169. 1928. Telia unknown.

UREDO UNCINATA Kern, Cif. et Thurston Ann. Mycol. 31: 27. 1933.
On Dorstenia drakena L., Dorstenia sp. : Dominican Republic, Honduras.

Uredo unilateralis Arth. : See POLIOMA UNILATERALIS (Arth.) J. W. Baxter et Cumm.

UREDO VICINA Arth. Mycologia 7: 325. 1915.

UREDO WILSONII Arth. Bull. Torr. Bot. Club 37: 577. 1910.

**UREDO XYRIDIS Mains Contrib. Univ. Mich. Herb. 1: 17. 1939.
On Xyris sp.: British Honduras.

**UREDO YUCATANENSIS Mains Contrib. Univ. Mich. Herb. 1: 17. 1939.
On Mimosa albida Humb. et Bonpl.: British Honduras.

UREDO ZEUGITES Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 538. 1918.
Puccinia zeugites Barth. Handbook No. Amer. Ured. Ed. 1, p. 175. 1928. Telia unknown.

UROMYCES ABBREVIATUS Arth. Bull. Torr. Bot. Club 42: 587. 1915.

UROMYCES ACUMINATUS Arth. Bull. Minn. Acad. 2: 35. 1883.
Arthur (Manual Rusts U. S. and Canada, p. 168. 1934.) lists four varieties based on host differences and minor morphological differences in telial spores: U. acuminatus magnatus (Arth.) J. J. Davis, U. acuminatus polemonii (Pk.) J. J. Davis, U. acuminatus spartinae (Farl.) Arth., U. acuminatus steironematis (Arth.) J. J. Davis.

UROMYCES AEGOPOGONIS Diet. et Holw. in Holw. Bot. Gaz. 24: 25. 1897.

UROMYCES AEMULUS Arth. Bull. Torr. Bot. Club 38: 373. 1911.

UROMYCES AFFINIS Wint. Hedwigia 24: 259. 1885.
On Hypoxis erecta L.: Missouri. Other specimens referred here (No. Amer. Flora 7: 755. 1926) belong with Uromyces necopinus Cumm. and Uredo hypoxidis P. Henn. (q. v.).

UROMYCES AGNATUS Arth. Bull. Torr. Bot. Club 38: 378. 1911.

Uromyces alopecuri Seym.: See UROMYCES DACTYLIDIS Otth

UROMYCES AMERICANUS Speg. Anal. Mus. Nac. Buenos Aires 19: 310. 1909.
On Scirpus americanus Pers., S. californicus (Mey.) Britt., S. validus Vahl.: Canada, U.S.A., Bermuda. Segregated from U. scirpi Burr.

UROMYCES AMOENUS Syd. Ann. Mycol. 4: 28. 1906.

UROMYCES AMPHIDYMUS Syd. Ann. Mycol. 4: 29. 1906

UROMYCES ANDROPOGONIS Tracy Jour. Myc. 7: 281. 1893.

UROMYCES ANTHACANTHI Jacks. in Seaver Mycologia 16: 47. 1924.

UROMYCES ANTIGUANUS Cumm. Bull. Torr. Bot. Club 67: 612. 1940.
On Desmodium orbiculare Schlecht.: Guatemala. Segregated from U. hedysari-paniculati (Schw.) Farl.

**UROMYCES APHELANDRAE Syd. Ann. Mycol. 23: 311. 1925.
On Aphelandra pectinata Willd.: Costa Rica.

UROMYCES APIOSPORUS Hazsl. Ungar. Akad. Wiss. 10: 44. 1873.

Uromyces appendiculatus (Pers.) Lk.: See UROMYCES PHASEOLI (Pers.) Wint.

UROMYCES ARCHERIANUS Arth. et Fromme Torreya 15: 261. 1915.

UROMYCES ARGUTUS Kern Torreya 11: 214. 1911.

UROMYCES ARISTIDAE Ell. et Ev. Jour. Myc. 3: 56. 1887.

UROMYCES ARI-TRIPHYLLI (Schw.) Seeler Rhodora 44: 174. 1942.
Uredo caladii Schw. Schr. Nat. Ges. Leipzig 1: 71. 1822.
Puccinia ari-triphylli Schw. Trans. Amer. Phil. Soc. II. 4: 297. 1832.
Uromyces caladii Farl. in Ell. No. Amer. Fungi, No. 232. 1879.

UROMYCES ARMERIAE Lév. ex Kickx Fl. Crypt. Flandres 2: 73. 1867.
Caeoma armeriae Schlecht. Fl. Berol. 2: 126. 1824. See NOTE 1, p. 110.
See also U. limonii (DC.) Lév. and U. limonii-caroliniani Savile et Conners

UROMYCES ARMERIAE Lév. subsp. HUDSONICUS Savile et Conners Mycologia 43: 190. 1951.
On Armeria maritima var. labradorica (Wallr.) Lawrence: Canada.

UROMYCES ARMERIAE Lév. subsp. PACIFICUS Savile et Conners Mycologia 43: 191. 1951.
On Armeria maritima Willd.: California, Oregon, British Columbia.

UROMYCES ASCLEPIADIS Cke. Grevillea 5: 152. 1877.
Uredo asclepiadis Schw. ex Berk. et Curt. Jour. Acad. Sci. Phil. II 2: 282. 1853. See NOTE 1, p. 110.

UROMYCES AUREUS Diet. et Holw. in Diet. Hedwigia 32: 30. 1893.

UROMYCES BAUHINIICOLA Arth. Bot. Gaz. 39: 389. 1905.

UROMYCES BECKMANNIAE Jacks. Brooklyn Bot. Garden Mem. 1: 274. 1918.

**UROMYCES BERMUDIANUS Cumm. Bull. Torr. Bot. Club 68: 470. 1941.
On Cyperus paniculatus Rottb.: Bermuda.

UROMYCES BETAE Tul. ex Kickx Fl. Crypt. Flandres 2: 74. 1867.
Uredo betae Pers. Syn. Meth. Fung. p. 220. 1801. See NOTE 1, p. 110.
Uromyces betae Lév. Ann. Sci. Nat. III, 8: 375. 1847. Telia not described.
Uromyces betae Tul. Ann. Sci. Nat. IV, 2: 89. 1854. Telia not described.
Uredo betaecola Belk. ex West. Bull. Acad. Roy. Belg. II, 11: 650. 1861.
Hylander, Jørstad and Nannfeldt (loc. cit. p. 87.) note that the type of Uredo betaecola contains telia. A transfer to Uromyces might be based on this fact, but we prefer to maintain the established name for the common beet rust fungus.

UROMYCES BICOLOR Ell. ex Coville Contrib. U. S. Nat. Herb. 4: 231. 1893.

UROMYCES BIDENTICOLA Arth. Mycologia 9: 71. 1917.
Uredo bidentis P. Henn. Hedwigia 35: 251. 1896.
Uredo bidenticola P. Henn. Hedwigia 37: 279. 1898. See NOTE 1, p. 110.

UROMYCES BIDENTIS Lagh. Bull. Soc. Myc. France 11: 213. 1895.

**UROMYCES BONARIENSIS Speg. Anal. Soc. Cien. Argent. 10: 133. 1880.
On Gomphrena tuerckheimii (Vatke) Uline et Bray, Gomphrena sp.: Guatemala, Nicaragua.

UROMYCES BOUVARDIAE Syd. Ann. Mycol. 1: 16. 1903.

UROMYCES BRODIAEAE Ell. et Hark. Bull. Calif. Acad. 1: 28. 1884.

Uromyces caladii (Schw.) Farl.: See U. ARI-TRIPHYLLI (Schw.) Seeler

**UROMYCES CALOPOGONII Cumm. Bull. Torr. Bot. Club 70: 80. 1943.
On Calopogonium galactioides (H. B. K.) Benth.: Guatemala.

Uromyces caryophyllinus (Schrank.) Wint.: See U. DIANTHI Niessl

UROMYCES CELOSIAE Diet. et Holw. in Holw. Bot. Gaz. 31: 326. 1901.

UROMYCES CESTRI Mont. in Gay Hist. Fis. Polit. Chile 8: 49. 1852.
Aecidium cestri Mont. Ann. Sci. Nat. II, 3: 356. 1835.
Uromyces cestri Lév. Ann. Sci. Nat. III, 8: 371. 1847. (Nomen nudum).
On Cestrum diurnum L.: Florida.

Uromyces chenopodii (Duby) Schroet.: See U. GIGANTEUS Speg.

UROMYCES CLAYTONIAE Cke. et Pk. in Pk. Ann. Report N. Y. State Mus. 29: 50. 1878.
Has been cited in error as U. claytoniae G. W. Clint. et Pk.

UROMYCES CLIGNYI Pat. et Har. Jour. de Bot. 14: 237. 1900.

UROMYCES CLITORIAE Arth. Bot. Gaz. 39: 389. 1905.

UROMYCES COLOGANIAE Arth. Bot. Gaz. 39: 387. 1905.

UROMYCES COLORADENSIS Ell. et Ev. Erythea 1: 204. 1893.

UROMYCES COLORADENSIS Ell. et Ev. var. CAMPESTER Arth. Manual Rusts U. S. and Canada, p. 301. 1934.

UROMYCES COLORADENSIS Ell. et Ev. var. MARITIMUS Arth. Manual Rusts U. S. and Canada, p. 301. 1934.

UROMYCES COLORADENSIS Ell. et Ev. var. MONTANUS Arth. Manual Rusts U. S. and Canada, p. 301. 1934.

UROMYCES COLUMBIANUS Mayor Mem. Soc. Neuch. Sci. Nat. 5: 467. 1913.

UROMYCES COLUTEAE Arth. Bull. Torr. Bot. Club 37: 574. 1910.
Probably belongs in the collective species U. pisi (DC.) Otth as treated by Hylander, Jørstad, and Nannfeldt (loc. cit. p. 93).

**UROMYCES COMEDENS Syd. Monogr. Ured. 2: 37. 1910.
On Jasminum (pubescens Willd. ?): Dominican Republic. Imported but perhaps not persisting.

UROMYCES COMMELINAE Cke. Trans. Roy. Soc. Edinb. 31: 342. 1888.
Uredo commelinae Speg. Anal. Soc. Cien. Argent. 9: 172. 1880.
See NOTE 1, p. 110.

UROMYCES COMPACTUS Pk. Bot. Gaz. 7: 56. 1882.

UROMYCES COORDINATUS Arth. Bull. Torr. Bot. Club 48: 33. 1921.

UROMYCES COSTARICENSIS Syd. Ann. Mycol. 23: 312. 1925.
On Lasiacis spp.: Costa Rica. Segregated from U. leptodermus Syd.

UROMYCES CUCULLATUS Syd. Ann. Mycol. 2: 349. 1904.

UROMYCES DACTYLIDIS Otth Mitth. Nat. Ges. Bern 1861: 85. 1861.
Uromyces alopecuri Seym. Proc. Boston Soc. Nat. Hist. 24: 186. 1889.

UROMYCES DECORATUS Syd. Ann. Mycol. 5: 491. 1907.

UROMYCES DIANTHI (Pers.) Niessl Verh. Naturf. Ver. Brünn 10: 162. 1872.
Lycoperdon caryophyllinum Schrank Baier. Flor. 2: 668. 1789. A pre-starting point name.
Uredo dianthi Pers. Syn. Meth. Fung., p. 222. 1801. (Contains telia).
Uromyces caryophyllinus Wint. in Rabh. Krypt. Fl. 1: 149. 1881.

UROMYCES DICHROMENAE Dale Myc. Papers Commonw. Myc. Inst. 59: 10. 1955.
Doubtfully reported by Dale (loc. cit. 60: 16. 1955.) on Dichromena radicans Cham. et Schlecht. from Jamaica.

UROMYCES DICTYOSPERMA Ell. et Ev. ex Tranzschel Ann. Mycol. 8: 12. 1910.
Uromyces dictyosperma Ell. et Ev. No. Amer. Fungi No. 2882. 1893. Nomen nudum.

UROMYCES DOLICHOLI Arth. Bull. Torr. Bot. Club 33: 27. 1906.

UROMYCES DOLICHOSPORUS Diet. et Holw. in Holw. Bot. Gaz. 31: 327. 1901.
Poliotelium dolichosporum Mains Bull. Torr. Bot. Club 66: 175. 1939.

UROMYCES ELEGANS Lagh. Tromsö Mus. Aarsh. 17: 34. 1895.
Aecidium orobi elegans Berk. Grevillea 3: 61. 1874. See NOTE 1, p. 110.

UROMYCES ELEOCHARIDIS Arth. Bull. Torr. Bot. Club 33: 514. 1906.

UROMYCES EPICAMPIS Diet. et Holw. in Holw. Bot. Gaz. 24: 23. 1897.

UROMYCES ERAGROSTIDIS Tracy Jour. Myc. 7: 281. 1893.

UROMYCES EUGENTIANAE Cumm. Mycologia 48: 608. 1956.
Uromyces gentianae Arth. Bot. Gaz. 16: 227. 1891. (Non Lév. 1847).

UROMYCES EUPHLEBIUS Syd. Ann. Mycol. 18: 154. 1920.

UROMYCES EUPHORBIAE Cke. et Pk. in Pk. Ann. Report N. Y. State Mus. 25: 90. 1873.
Uredo proëminens DC. Fl. Fr. 2: 235. 1805.
Uromyces proëminens Pass. in Rabh. Fungi Eur. Exsic. (Ed. Nov.), No. 1795. 1874. Telia not described.
Arthur (Manual Rusts U. S. and Canada, p. 309. 1934.) sets up four "varieties" for the most part on a host basis.

UROMYCES EVASTIGATUS Cumm. Mycologia 31: 173. 1939.
On Phthirusa pyrifolia (H. B. K.) Eichl.: El Salvador. Segregated from U. urbanianus P. Henn.

UROMYCES FABAE (Grev.) DBy ex Cke. Grevillea 7: 135. 1879.
Uredo fabae Pers. Neues Mag. Bot. 1: 93. 1794. A pre-starting point name.
Uredo viciae-fabae Pers. Syn. Meth. Fung., p. 221. 1801. See NOTE 1, p. 110.
Puccinia fabae Grev. Scott Crypt. Flora 1: Tab. 29. 1823.
Uromyces fabae DBy. Ann. Sci. Nat. Bot. IV, 20: 80. 1863. (Nomen nudum.)

*UROMYCES GALII-CALIFORNICI Linder Mycologia 30: 668. 1938.
On Galium californicum Hook. et Arn.: California.

UROMYCES GALPHIMIAE Diet. et Holw. in Holw. Bot. Gaz. 24: 25. 1897.

UROMYCES GEMMATUS Berk. et Curt. in Berk. Jour. Linn. Soc. 10: 357. 1869.

Uromyces gentianae Arth.: See UROMYCES EUGENTIANAE Cumm.

UROMYCES GERANII (DC.) Lév. Ann. Sci. Nat. Bot. III. 8: 371. 1847.
Uredo geranii DC. in Lam. et DC. Syn. Pl. Gall., p. 247. 1806. (Telia present).
Uromyces geranii Fr. Summa Veg. Scand., p. 514. 1849.

UROMYCES GIGANTEUS Speg. Dec. Mycol. Ital. No. 30. 1879.
Uredo chenopodii Duby Bot. Gall. 2: 899. 1830. See NOTE 1, p. 110.
Uromyces chenopodii Schroet. in Kunze Fungi Sel. No. 214. 1880.
Uromyces chenopodii-fruticosi Barth. Handbook No. Amer. Ured., ed. 1, p. 58. 1928.

UROMYCES GLOBOSUS Diet. et Holw. in Holw. Bot. Gaz. 24: 23. 1897.

UROMYCES GLYCYRRHIZAE Magn. Ber. Deutsch. Bot. Ges. 8: 383. 1890.
Uredo leguminosarum glycyrrhizae Rabh. Flora 33: 626. 1850. See NOTE 1, p. 110.

UROMYCES GOUANIAE Kern Mycologia 3: 290. 1911.

UROMYCES GRAMINICOLA Burr. Bot. Gaz. 9: 188. 1884.

UROMYCES GUATEMALENSIS Vest. Ark. Bot. 4: 20. 1905.

UROMYCES HALSTEDII deT. in Sacc. Syll. Fung. 7: 557. 1888.

UROMYCES HARIOTIANUS Lagh. ex Arth. Mycologia 10: 125. 1918.

UROMYCES HEDYSARI-OBSCURI (DC.) Lév. in Orbigny Dict. Univ. Hist. Nat. 12: 786. 1849.
Puccinia hedysari-obscuri DC. Syn. Pl. Gall., p. 46. 1806.
Uromyces hedysari-obscuri Car. et Picc. Erb. Critt. Ital. II, No. 447. 1871

UROMYCES HEDYSARI-PANICULATI (Schw.) Farl. in Ell. No. Amer. Fungi, No. 246. 1879.
See also U. antiguanus Cumm.

*UROMYCES HELLERIANUS Arth. Bull. Torr. Bot. Club 31: 2. 1904.
On Melothria pendula L. : Florida.

UROMYCES HETERANTHERAE Syd. Monogr. Ured. 2: 291. 1910.
On Heteranthera reniformis Ruiz et Pav. : Costa Rica.

UROMYCES HETERODERMUS Syd. Ann. Mycol. 4: 29. 1906.

UROMYCES HOLWAYI Lagh. Hedwigia 28: 108. 1889.

UROMYCES HORDEINUS (Arth.) Barth. Handbook No. Amer. Ured. ed. 1, p. 63. 1928.
Uromyces hordeinus Arth. Manual Rusts U. S. and Canada, p. 177. 1934.

UROMYCES HOUSTONIATUS Sheldon Torreya 9: 55. 1909.
Caeoma houstoniatum Schw. Trans. Amer. Phil. Soc. II 4: 293. 1832. See NOTE 1, p. 110.

UROMYCES HYALINUS Pk. Bot. Gaz. 3: 34. 1878.

Uromyces hyperici (Spreng.) Curt. : See UROMYCES TRIQUETRUS Cke.

UROMYCES ICTERICUS Cumm. Bull. Torr. Bot. Club 68: 45. 1941.
On Iresine celosia L. : Guatemala. Segregated from Uromyces iresines Lagh.

Uromyces ignobilis (Syd.) Arth. : See UROMYCES TENUICUTIS McAlp. and U. MAJOR Arth.

UROMYCES ILLOTUS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 441. 1918.

UROMYCES IMPERFECTUS Arth. Bull. Torr. Bot. Club 47: 472. 1920.

UROMYCES INAEQUIALTUS Lasch ex Rabh. Fungi Eur., No. 94. 1859.
Caeoma silenes Schlecht. Flor. Berol., p. 128. 1824. See NOTE 1, p. 110.
Uromyces silenes Fckl. Jahr. Nass. Ver. Nat. 23-24: 61. 1870.

UROMYCES INDIGOFERAE Diet. et Holw. in Holw. Bot. Gaz. 31: 328. 1901.

UROMYCES INDURATUS Syd. et Holw. in Syd. Ann. Mycol. 1: 16. 1903.
Aecidium tweedianum Speg. Anal. Soc. Cien. Argent. 10: 11. 1880. See NOTE 1, p. 110.
Uromyces tweedianus Barth. Handbook No. Amer. Ured. ed. 1, p. 79. 1928.

UROMYCES INTRICATUS Cke. Grevillea 7: 3. 1878.

UROMYCES IRESINES Lagh. ex Syd. Monogr. Ured. 2: 227. 1910.
This species is not definitely known from North America. Guatemalan records are U. ictericus Cumm. The rust on I. elatior probably represents an undescribed species.

Uromyces jacksonii Arth. et Fromme: See UROMYCES MYSTICUS Arth.

UROMYCES JAMAICENSIS Vest. Ark. Bot. 4 (15): 33. 1905.

Uromyces janiphae (Wint.) Arth. : See UROMYCES JATROPHAE Diet. et Holw.

UROMYCES JATROPHAE Diet. et Holw. in Holw. Bot. Gaz. 24: 25. 1897.
Uredo janiphae Wint. Grevillea 15: 86. 1887. See NOTE 1, p. 110.
Uromyces janiphae Arth. Mycologia 7: 190. 1915.

UROMYCES JONESII Pk. Bot. Gaz. 7: 45. 1882.

UROMYCES JUNCI (Desm.) Tul. Ann. Sci. Nat. IV 2: 146. 1854.

UROMYCES JUNCI-EFFUSI Syd. Monogr. Ured. 2: 290. 1910.

UROMYCES KRAMERIAE Long in Arth. Bull. Torr. Bot. Club 45: 143. 1918.

UROMYCES LAPPONICUS Lagh. Bot. Notiser 1890: 274. 1890.

UROMYCES LEPTODERMUS Syd. in Syd. et Butl. Ann. Mycol. 4: 430. 1906.

UROMYCES LESPEDEZAE-PROCUMBENTIS (Schw.) Curt. Cat. Pl. No. Car., p. 123. 1867.

UROMYCES LIMONII (DC.) Lév. in Orbigny Dict. Univ. Hist. Nat. 12: 786. 1849.
See also U. armeriae Lév. and U. limonii-caroliniani Savile et Conners

UROMYCES LIMONII (DC.) Lév. var. ARMERIAE Arth. Manual Rusts U. S. and Canada, p. 252. 1934.

UROMYCES LIMONII-CAROLINIANI Savile et Conners Mycologia 43: 193. 1951.
On Limonium carolinianum Walt. : Canada, Mississippi. Segregated from Uromyces limonii (DC.) Lév.

UROMYCES LINEOLATUS (Desm.) Schroet. in Rabh. Fungi Eur. No. 2077. 1876.
Uredo scirpi Cast. Cat. Pl. Marseille, p. 214. 1845.
Puccinia lineolata Desm. Ann. Sci. Nat. Bot. III, 11: 273. 1849.
Uromyces scirpi Burr. Bot. Gaz. 9: 188. 1884.

UROMYCES LUPINI Berk. et Curt. Proc. Amer. Acad. Sci. 4: 126. 1858.

UROMYCES LYCOCTONI (Kalchbr.) Trott. Fl. Ital. Crypt. 1: 64. 1908.
Uredo lycoctoni Kalchbr. Math. Term. Közlem. 3: 306. 1865. The type has telia.

UROMYCES MACULANS (Pat.) Arth. Mycologia 10: 124. 1918.

UROMYCES MAJOR Arth. Bull. Torr. Bot. Club 38: 377. 1911.
Uromyces ignobilis Arth. sensu Arth. Manual Rusts U. S. and Canada, p. 137. 1934.
On Muhlenbergia reverchonii Vasey: Texas; and Muhlenbergia sp.: Mexico.

UROMYCES MARTINII Farl. Proc. Amer. Acad. Sci. 18: 78. 1883.

UROMYCES MAYORII Tranz. ex Mayor Mem. Soc. Neuch. Sci. Nat. 5: 463. 1913.

*UROMYCES MEXICANUS Diet. et Holw. in Holw. Bot. Gaz. 24: 24. 1897.
On Desmodium sp.: New Mexico.

UROMYCES MINIMUS J. J. Davis Bot. Gaz. 19: 415. 1894.

UROMYCES MINOR Schroet. in Cohn Krypt. Fl. Schles. III. 1: 310. 1887.

UROMYCES MINUTUS Diet. ex Atk. Bull. Cornell Univ. 3: 21. 1897.

UROMYCES MIURAE Syd. Ann. Mycol. 11: 94. 1913.

UROMYCES MONTANOAE Arth. et Holw. in Arth. Mycologia 10: 127. 1918.

UROMYCES MONTANUS Arth. Bot. Gaz. 39: 386. 1905.

UROMYCES MYRSINES Diet. Hedwigia 36: 26. 1897.

UROMYCES MYSTICUS Arth. Bull. Torr. Bot. Club 38: 377. 1911.
Uromyces jacksonii Arth. et Fromme Torreya 15: 260. 1915.

UROMYCES NECOPINUS Cumm. Bull. Torr. Bot. Club 68: 46. 1941.
On Hypoxis hirsuta (L.) Cov.: Connecticut, New York. Segregated from Uromyces affinis Wint.

UROMYCES NEUROCARPI Diet. Hedwigia 34: 292. 1895.

UROMYCES NERVIPHILUS (Grog.) Hotson Publ. Puget Sound Biol. Sta. Univ. Wash. 4: 368. 1925.

*UROMYCES OAXACANUS Diet. et Holw. in Holw. Bot. Gaz. 31: 327. 1901.
On Jatropha angustidens (Torr.) Muell.-Arg.: Arizona.

UROMYCES OBLONGISPORUS Ell. et Ev. Bull. Torr. Bot. Club 25: 507. 1898.

UROMYCES OCCIDENTALIS Diet. Hedwigia 42 (Beibl.): 98. 1903.

UROMYCES ORNATIPES Arth. Bull. Torr. Bot. Club 42: 586. 1915.

UROMYCES PECKIANUS Farl. Proc. Amer. Acad. Sci. 18: 78. 1883.

UROMYCES PERIGYNIUS Halst. Jour. Myc. 5: 11. 1889.

UROMYCES PHACAE-FRIGIDAE (Wahl.) Hariot Jour. de Bot. 7: 376. 1893.
Aecidium phacae-frigidae Wahl. Fl. Lapp., p. 525. 1812. The type contains telia.

UROMYCES PHASEOLI (Reben.) Wint. in Rab. Krypt. Fl. 1: 157. 1881.
Uredo appendiculata phaseoli Pers. Syn. Meth. Fung., p. 222. 1801.
Puccinia phaseoli Reben. Prodr. Fl. Neom., p. 356. 1804.

Hylander, Jørstad, and Nannfeldt (loc. cit. p. 86) cite this species as Uromyces appendiculatus (Pers.) Unger. Unger (Exanthema Pfl., pp. 277-282. 1833.) mentions Uredo appendiculata Pers. (p. 279), but does not use the name Uromyces appendiculatus. Hence Unger cannot be cited as the authority on the basis of this reference. In a later publication (Einfl. Bodens, p. 216. 1936) Unger does use the binomial Uromyces appendiculatus but it applies obviously to U. fabae since he lists only Vicia spp. as hosts, hence it cannot apply to the rust on Phaseolus.

UROMYCES PIANHYENSIS P. Henn. Hedwigia 47: 266. 1908.

UROMYCES PISI (DC.) Otth Mitth. Naturf. Ges. Bern 1863: 87. 1863.

Hylander, Jørstad and Nannfeldt (loc. cit. pp. 93-95) bring together under U. pisi as a collective name "various closely allied leguminous rust races, usually considered as species." Of these, two, Uromyces punctatus Schroet. and U. striatus Schroet., occur in North America and are considered in due course in this check list. U. pisi as such is not reported for the area.

UROMYCES PLUMBARIUS Pk. Bot. Gaz. 4: 127. 1879.

**UROMYCES POLIOTELIS Syd. Ann. Mycol. 23: 313. 1925.
On Anguria sp.: Costa Rica.

Uromyces polygoni (Pers.) Fckl.: See U. POLYGONI-AVICULARIAE (Pers.) Karst.

UROMYCES POLYGONI-AVICULARIS (Pers.) Karst. Bidr. Känned. Finl. Nat. Folk 4: 12. 1879.
Puccinia polygoni Pers. Neues Mag. Bot. 1: 119. 1794. Pre-starting point name.
Puccinia polygoni-aviculariae Pers. Syn. Meth. Fung., p. 227. 1801.
Uromyces polygoni-avicularis Otth Mitth. Naturf. Ges. Bern 1861: 73. 1861. (Nomen nudum)
Uromyces polygoni Fckl. Jahrb. Nass. Ver. Nat. 23-24: 64: 1870. A rejected name. See Art. 65(2) of the Code.

UROMYCES POLYMNIAE Diet. et Holw. in Holw. Bot. Gaz. 31: 327. 1901.
Uredo polymniae P. Henn. Hedwigia 38 (Beibl.): 129. 1899. See NOTE 1, p. 110.

UROMYCES PONTEDERIAE Gerard Bull. Torr. Bot. Club 6: 31. 1875.

Uromyces pressus Arth. et Holw.: See MARAVALIA PRESSA (Arth. et Holw.) Mains

UROMYCES PRIMAVERILIS Speg. Anal. Soc. Cien. Argentina 12: 72. 1881.

UROMYCES PROBUS Arth. Bull. Torr. Bot. Club 38: 376. 1911.

Uromyces proëminens (DC.) Pass.: See U. EUPHORBIAE Cke. et Pk.

UROMYCES PSORALEAE Pk. Bot. Gaz. 6: 239. 1881.
Arthur (Manual Rusts U. S. and Canada, p. 244-245. 1934.) sets up under this species Uromyces psoraleae Pk. var. typica Arth. and U. psoraleae Pk. var. argophyllae (Seym.) Arth. based on host differences and minor morphological characters of the teliospores.

UROMYCES PUNCTATUS Schroet. Abh. Schles. Ges. Vaterl. Cult. Nat. Abth. 1869-72: 10. 1870.
See Uromyces pisi (DC.) Otth

UROMYCES PUNCTIFORMIS Syd. Ured. Exsic. No. 1513. 1901.

UROMYCES PUTTEMANSII Rangel Arch. Mus. Nac. de Janeiro 18: 159. 1916.
Uromyces sepultus Mains Carnegie Inst. Wash. Publ. 461: 99. 1935.
On Setaria spp. Segregated from U. leptodermus Syd.

Uromyces pyriformis Cke.: See U. SPARGANII Cke. et Pk.

UROMYCES RHYNCHOSPORAE Ell. Jour. Myc. 7: 274. 1893.

UROMYCES RICKERIANUS Arth. Bull. Torr. Bot. Club 29: 227. 1902.

UROMYCES RUDBECKIAE Arth. et Holw. in Arth. Iowa Agric. Coll. Bull. 1884: 154. 1885.

UROMYCES RUELLIAE Holw. Ann. Mycol. 2: 394. 1904.

UROMYCES SABINEAE Arth. Mycologia 9: 69. 1917.

UROMYCES SALMEAE Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 445. 1918.

UROMYCES SCILLARUM (Grev. ex Berk.) Lév. Ann. Sci. Nat. III, 8: 376. 1847.
Uredo scillarum Grev. ex Berk. in Smith Engl. Flora 5: 376. 1836.
The type here contains telia.
Uromyces scillarum Wint. in Rabh. Krypt. Fl. 1: 142. 1881.

Uromyces scirpi (Cast.) Burr.: See U. LINEOLATUS (Desm.) Schroet.

UROMYCES SCLERIAE P. Henn. Hedwigia 38 (Beibl.): 67. 1899.

UROMYCES SENECIONICOLA Arth. Bot. Gaz. 40. 198. 1905.

Uromyces sepultus Mains: See U. PUTTEMANSII Rangel

UROMYCES SHEARIANUS Arth. Bull. Torr. Bot. Club 46: 120. 1919.

Uromyces silenes (Schlecht.) Fckl.: See U. INAEQUIALTUS Lasch

UROMYCES SILPHII Arth. Jour. Myc. 13: 202. 1907.
Aecidium compositarum silphii Burr. in DeT. in Sacc. Syll. Fung. 7: 798. 1888. See NOTE 1, p. 110.

UROMYCES SOCIUS Arth. et Holw. in Arth. Amer. Jour. Bot. 5: 437. 1918.

UROMYCES SOLANI Diet. et Holw. in Holw. Bot. Gaz. 24: 24. 1897.

Uromyces solidaginis (Sommerf.) Niessl: See U. SOMMERFELTII Hylander, Jørstad, et Nannf.

UROMYCES SOMMERFELTII Hylander, Jørstad, et Nannf. Opera Bot. 1: 96. 1953.
Caeoma solidaginis Sommerf. Supplem. Fl. Lapp., p. 234. 1826. The type here contains telia.
Uromyces solidaginis Niessl Verh. Naturf. Ver. Brünn 10: 163. 1872. (Non Fckl., 1860).

UROMYCES SPARGANII Cke. et Pk. in Pk. Ann. Report N. Y. State Mus. 26: 77. 1874.
Uromyces pyrformis Cke. in Pk. Ann. Report N. Y. State Mus. 29: 69. 1878.
According to Parmelee and Savile (Mycologia 46: 823-836. 1954) this species produces aecia on Hypericum spp.

UROMYCES SPECIOSUS Holw. Ann. Mycol. 3: 23. 1905.

UROMYCES SPERMACOCES (Schw.) Curt. Cat. Fl. No. Car., p. 123. 1867.

UROMYCES SPOROBOLI Ell. et Ev. Proc. Acad. Sci. Phil. 1893: 155. 1893.

Uromyces spragueae Hark.: See UROMYCES UNITUS Pk. subsp. SPRAGUEAE (Hark.) Savile

UROMYCES STANDLEYANUS Arth. Bull. Torr. Bot. Club 51: 57. 1924.

UROMYCES STRIATUS Schroet. Abh. Schles. Ges. Vaterl. Cult. Nat. Abth. 1869-72: 11. 1870.
Hylander, Jørstad, and Nannfeldt treat this as a form of U. pisi (DC.) Otth.
Arthur (Manual Rusts U. S. and Canada, pp. 301, and 302. 1934.) sets up the varieties U. striatus medicaginis (Pass.) Arth. and U. striatus loti (Blytt) Arth., based on host differences and "only slight morphologic differences."

UROMYCES SUKSDORFII Diet. et Holw. in Diet. Erythea 3: 77. 1895.

UROMYCES TENUICUTIS McAlp. Rusts of Australia, p. 87. 1906.
Uredo ignobilis Syd. Ann. Mycol. 4: 444. 1906. See NOTE 1, p. 110.
Uromyces ignobilis Arth. Mycologia 7: 181. 1915. Telia not described.
For hosts and distribution see under Nigredo ignobilis (Syd.) Arth. (No. Amer. Flora 7: 746. 1926) except for Muhlenbergia reverchonii, for which see U. major Arth.

UROMYCES TENUISTIPES Diet. et Holw. in Holw. Bot. Gaz. 24: 25. 1897.

UROMYCES TRANZSCHELII Syd. in Tranz. Ann. Mycol. 8: 20. 1910.

Uromyces tricholaenae Gonz. Frag. et Cif.: See PUCCINIA LEVIS (Sacc. et Bizz.) Magn.

UROMYCES TRIFOLII (Hedw. f. ex DC.) Lév. Ann. Sci. Nat. III, 8: 371. 1847.
Puccinia trifolii Hedw. f. ex DC. Fl. Fr. 2: 225. 1805.
Aecidium trifolii-repentis Cast. Obs. Pl. Acotyl. 1: 33. 1842. See NOTE 1, p. 110.
Uromyces trifolii-repentis Liro Acta Soc. Fauna Fl. Fenn. 29 (6): 15. 1906. Telia not described.
Uromyces trifolii-repentis Liro Bidr. Känned Finl. Nat. Folk 65: 94. 1908.
Arthur (Manual Rusts U. S. and Canada, p. 304-305. 1934.) sets up three varieties based on host differences, Uromyces trifolii (Hedw. f. ex DC.) Lév. var. trifolii-repentis (Liro) Arth., Uromyces trifolii (Hedw. f. ex DC.) Lév. var. hybridi (W. H. Davis) Arth., and Uromyces trifolii (Hedw. f. ex DC.) Lév. var. fallens (Desm.) Arth. Hylander, Jørstad, and Nannfeldt (loc. cit. p. 97) prefer to use the binomial Uromyces trifolii-repentis Liro for the first two of these forms and Uromyces fallens Kern for the third. However, the description of Puccinia trifolii and the subsequent transfer to Uromyces appear to be in accordance with the provisions of the Code.

UROMYCES TRIQUETRUS Cke. Proc. Portland Soc. Nat. Hist. 1: 184. 1862.
Uredo hyperici Spreng. Syst. Veg. 4: 572. 1827. See NOTE 1, p. 110.
Uromyces hyperici Curt. Cat. Pl. No. Car., p. 123. 1867.

Uromyces tweedianus (Speg.) Barth.: See U. INDURATUS Syd. et Holw.

UROMYCES UNIPORULUS Kern Rhodora 12: 125. 1910.

UROMYCES UNITUS Pk. Bull. Torr. Bot. Club 10: 74. 1883.

UROMYCES UNITUS Pk. subsp. UNITUS
This variety set up by Savile, Mycologia 48: 581. 1956, under the provisions of Art. 35 of the Code.

UROMYCES UNITUS Pk. subsp. MONTANENSIS Savile Mycologia 48: 582. 1956.
On Lewisia rediviva Pursh: Montana.

UROMYCES UNITUS Pk. subsp. PACIFICUS Savile Mycologia 48: 583. 1956.
On Spraguea umbellata Torr.: California.

UROMYCES UNITUS Pk. subsp. SPRAGUEAE (Hark.) Savile Mycologia 48: 582. 1956.
Uromyces spragueae Hark. Bull. Calif. Acad. Sci. 1: 36. 1884.

**UROMYCES URBANIANUS P. Henn. Hedwigia 36: 213. 1897.
On Psittacanthus calyculatus (DC.) Don., P. sp.: Guatemala, Honduras. See also U. evastigatus Cumm.

UROMYCES VALENS Kern Rhodora 12: 125. 1910.

UROMYCES VENUSTUS Diet. et Holw. in Holw. Bot. Gaz. 31: 326. 1901.

UROMYCES VERRUCULOSUS Schroet. Jahres-Ber. Schles. Ges. Vaterl. Cult. 50: 140. 1873.

UROMYCES YURIMAGUASENSIS P. Henn. Hedwigia 43: 157. 1904.

UROMYCES ZYGADENI Pk. Bot. Gaz. 6: 239. 1881.

UROPYXIS AFFINIS Arth. Manual Rusts U. S. and Canada, p. 76. 1934.

UROPYXIS AMORPHAE (Curt.) Schroet. Hedwigia 14: 165. 1875.

UROPYXIS DALEAE (Diet. et Holw.) Magn. Ber. Deutsch. Bot. Ges. 17: 115. 1899.

UROPYXIS DIPHYSAE (Arth.) Cumm. Bull. Torr. Bot. Club 70: 81. 1943.

*UROPYXIS EYSENHARDTIAE (Diet. et Holw.) Magn. Ber. Deutsch. Bot. Ges. 17: 115. 1899.
On Dalea albiflora Gray, Eysenhardtia orthocarpa (Gray) Wats.: Arizona

UROPYXIS HOLWAYI (Arth.) Arth. Manual Rusts U. S. and Canada, p. 77. 1934.

UROPYXIS NISSOLIAE (Diet. et Holw.) Magn. Ber. Deutsch. Bot. Ges. 17: 115. 1899.

UROPYXIS PETALOSTEMONIS (Farl.) DeT. in Sacc. Syll. Fung. 7: 735. 1888.

UROPYXIS ROSEANA Arth. No. Amer. Flora 7: 157. 1907.

XENODOCHUS CARBONARIUS Schlecht. Linnaea 1: 237. 1826.

XENODOCHUS MINOR Arth. No. Amer. Flora 7: 182. 1912.

THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1955

Supplement 241

December 15, 1956

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch Plant Industry Station, Beltsville, Maryland

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1955

Compiled by Nellie W. Nance

Plant Disease Reporter
Supplement 241

December 15, 1956

As in former years, this is a summary of important diseases and developments compiled for the most part from reports to the Plant Disease Epidemics and Identification Section and from articles in Phytopathology. Reports listed in the tables are not usually noted again in the text.

There have been many recent outstanding advancements in the development of plant disease control by antibiotics, by use of antagonistic organisms, disease control in general, and the control of specific diseases caused by actinomycetes and fungi. It has been stated that more than 2, 000, 000 pounds of chemicals, costing $35,000, 000, are used annualy in the United States in the plant control program.

Since weather as related to plant disease development is such an important factor, a weather summary for the year follows.

WEATHER OF 1955. General Summary. - - Temperatures for 1955 averaged unusally low in the Far West and the Florida Peninsula, well above normal in the Great Lakes region and Northeast, and near normal elsewhere. Precipitation totals were far in excess of the usual amounts in the Pacific States, the northern Rocky Mountain region, and parts of eastern New York and southern New England, but were greatly deficient in Iowa, Missouri, and the central and lower Great Plains.

The seasons were featured by an unusually cool spring and summer in the Northwest, a spring drought in the western portions of the lower Great Plains, a hot, humid summer in the northeastern quarter of the Nation, and a fall drought in the Texas and Oklahoma Panhandles and adjoining areas.

Other highlights of short duration, and more or less localized, included August and Octtober floods in southern New England and adjoining areas. December floods in California and Oregon, a March freeze in the Southeast, a November freeze in the Northwest, Californa's heat wave and forest fires in September, Hurricane Ione which struck coastal areas of North Carolina and Virginia a damaging blow in September, and a July thundershower which set a new world's record for rainfall intensity at Jefferson, Iowa.

The year's weather, from an agricultural standpoint, was very favorable as reflected in total crop production near the record of 1948. This satisfactory result was due in great measure to timely and well distributed rainfall which prevented serious drought from developing in large areas during the critical growing season as it did in the three previous years. Nevertheless, drought and wind erosion during the spring and early summer ruined or damaged millions of acres of winter wheat in the lower Great Plains, and heat and drought during July and August sharply cut the corn crop in the western portion of the Corn Belt and grain sorghums in the central Great Plains.

January and February passed without any extraordinary weather events, although cold, blustery weather prevailed in the western half of the Nation during most of the latter month and the northern Great Plains had heavy snows and blizzards from the 18th to the 20th.

March, more than living up to its reputation as a month of extremes, started off with floods in the Ohio River which caused damage estimated at several millions, but unleashed its most violent weather during the last decade when blizzards swept the Great Plains as far south as Oklahoma and severe winds, tornadoes, glaze, heavy snow, and record cold caused damage in other sections totaling millions of dollars. The greatest damage, estimated at $50, 000, 000, resulted from the severe cold spell from the 26th to the 29th in the southern Great Plains and South including the lower Mississippi and Ohio Valleys. Temperatures which ranged from a record March low of -30^{o} for Helena, Mont., on the 25th to a late season low of 30^{o} for New Orleans, La., on the 27th caught many crops in an advanced stage of development due to record-breaking warm weather earlier in the month. Tung nuts and fruits, particularly peaches, which had reached the blossom stage where virtually all killed in the

Gulf and South Atlantic States, and peaches were severely damaged in lower elevations northward to southern Illinois and southeastern Virginia.

During April and May occasional strong winds continued to whip up severe duststorms in the Great Plains and Southwest. Of greater importance, however, was the combination of generous rainfall and above-normal temperatures which furnished the basis for an excellent crop outlook in the eastern agricultural half of the Nation.

June was an unusually cool and pleasant month over virtually the entire Nation. During July and August the weather east of the Rocky Mountains was characterized by a prolonged and persistent heat wave which was very unusual in that it was unaccompanied by any record-high temperatures or drought. August was also notable for hurricanes Connie and Diane which together dumped over 20 inches of rain in parts of the Northeast, resulting in one of the worst weather-caused disasters in the history of the United States when streams overflowed in southern New England, New Jersey, and parts of New York, and Pennsylvania resulting in the death of about 200 persons and property losses estimated in excess of three-quarters of a billion dollars. Heavy rainfall during July and August occurred in Arizona after the beginning of the summer thunderstorm season on July 10, and beneficial amounts fell in surrounding areas.

September weather was highlighted by a record heat wave in the Far West during the first 12 days. This heat wave was responsible for an all-time high temperature of 110^{o} in downtown Los Angeles, Calif., on the 1st, and it created an extremely high fire hazard in California where over 400 forest fires caused unprecedented losses. Hurricane Ione headlined the weather news on the 19th when its center moved across the north coastal area of North Carolina, causing damage in that state estimated at $88, 000, 000.

While southern New England was still recovering from the disastrous floods in August, another storm on October 14, 15, and 16 again brought more than 10 inches of rain resulting in major floods which caused more than 30 deaths and property losses estimated at many millions of dollars.

September and October, the first 2 fall months, were characterized by mild temperatures and ample periods of dry weather favorable for fall harvesting over most of the country. Crops reached maturity before the first freezes even though they came about 2 weeks early in parts of the South.

Unusually persistent, below-normal temperatures gave the Nation one of its coldest Novembers on record. In the Pacific Northwest record breaking cold was responsible for heavy agricultural losses. Cold weather continued until the middle of December when a change to milder temperatures occurred.

The change began in the Far West where it was ushered in with heavy rains. In northern California over 30 inches of rain in a 10-day period resulted in floods which were responsible for more than 50 deaths and preliminary damage estimates in excess of $100, 000, 000. Milder weather reached eastern sections of the Nation around Christmastime as many stations in the South and Southeast reported their highest temperatures on record for December 25. As the year ended, drought was developing in the Plains west of a line from Texas to Illinois and along the Eastern Seaboard.

PRECIPITATION. --Precipitation for 1955 was above normal in the Pacific States (except the southern third of California), along the Canadian Border from Washington to northern Wisconsin, western portions of Nebraska and Oklahoma, central Colorado, in a belt extending from northern Mississippi through most of Tennessee, Kentucky, and Indiana and parts of Illinois and Ohio, and another belt in the East extending from coastal areas of the Carolinas northward through eastern Virginia, Maryland, most of New York and New Jersey, and western and southern portions of New England. Elsewhere totals were below normal. Less than 75 percent of the normal amounts fell in southern Missouri, parts of the southern Rockies, and in a belt extending from northern Iowa and eastern Nebraska southward through the western portion of the lower Great Plains and including much of southern and eastern Texas.

The most serious drought conditions developed in western portions of Texas, Oklahoma, and Kansas, and eastern portions of New Mexico and Colorado during the spring months, and in northeastern New Mexico, southeastern Colorado, southwestern Kansas, and the northern portion of the Texas Panhandle in the fall. Drought threatened in several other areas during the year, but owing to timely rains usually failed to reach serious proportions.

A few local rainfalls of high intensity were of more than usual interest. The most notable was that recorded in Jefferson, Iowa, on July 10 when 0.69 inch of rain fell in one minute, setting a new world's record for rainfall intensity. On the same date an unusually high rate of rainfall at Sioux City, Iowa, caused damage estimated at $1,500,000. A 1-inch rainfall in 5 minutes set a new record at New Orleans, La., on February 5. A million dollar flash flood occurred in Little Rock, Ark., on May 26 when 3 inches fell in an hour, 4.60 inches in 2 hours, and 7.70 inches in 6 hours, all new records there. Las Vegas, Nev., had a $1,500,000 flash flood on June 13.

SNOWFALL. --Snowfall for 1955 in the Cascade and Sierra Nevada Mountains and the central and northern Rocky Mountains was generally above normal, with many stations meassuring unusally heavy annual falls. The most outstanding total was 903 inches measured at Paradise Ranger Station, Wash., which is 19 inches more than the 884-inches record seasonal fall at Tamarack, Calif., in 1906-07. Other large falls included Crater Lake, Oreg., 640 inches; Twin Lakes, Calif., 502; Stibnite, Idaho, 364; Kings Hill, Mont., 303; Snake River, Wyo., 285; Wolf Creek Pass, Colo., 435; and Silver Lake, Utah, 463 inches.

In the central interior yearly falls ranged from an inch or two in the northern portions of the southern states up to 224 inches at Houghton, Mich. In southern areas from one-half to nearly all the snowfall occurred in January.

In the Appalachian region falls ranged from about 3 inches in central Georgia up to 259 inches at Boonville, N. Y. On January 23 a little snow fell in some sections of northern Florida. During another storm in this State in March one inch fell at Marianna (greatest total for year) and flurries were reported as far south as Polk County.

TEMPERATURE. --Temperatures for 1955 averaged below normal in the Florida Peninsula, the northern Great Plains, and west of the Continental Divide, and above elsewhere. Anomalies ranged from 2^{o} above normal in northern Michigan to 3^{o} or more below in the northern Rockies and Pacific Northwest. Extreme readings for the year, ranging from 123^{o} at Greenland Ranch, Calif., on June 7 to -48^{o} at West Yellowstone, Mont., on December 15, were well within the limits of former records.

Relatively cool weather was unusally persistent in the Far West, particularly in central and northern coastal sections where only two pronounced warm spells occurred - these in early September and late December - and monthly averages showed minus departures for eleven of the twelve months. For Washington the months of March, April, and November were the coldest on record and the average for May equaled the former record. West of the great Lakes November was the coldest since 1896, and a cold snap about midmonth caused severe crop damage in Oregon and Washington with losses in the latter state estimated at $11,000,000.

In the Great Plains temperatures showed the usual fluctuations during the year, with February, June, and November decidedly colder than normal while the remaining months were mostly on the warm side. From the Mississippi Valley eastward, January, November, and December were decidedly cold, as were also June and October except in extreme northern areas. July, August, and the latter part of June were unusually warm and humid in middle and northern sections of this area. Also a warm spell in the latter half of December brought the warmest Christmas day on record to many southern stations. Other than the March freeze already mentioned, freezes also caused light to locally heavy crop damage in Florida on January 14-15, 30-31 and on February 12-13.

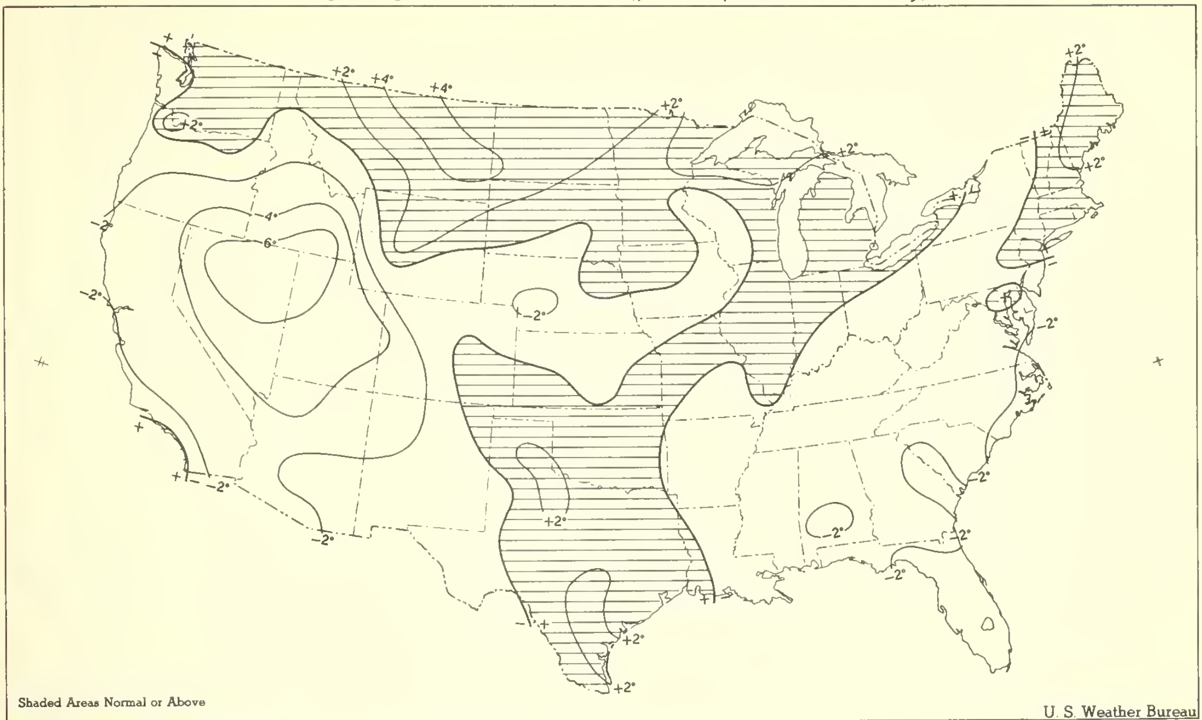
DESTRUCTIVE STORMS. --During 1955 damage caused by high winds, lightning, hail and tornadoes amounted to about one-half billion dollars. Over $400,000,000 of this total was attributed to winds, over $50,000,000 to hail, and more than $30,000,000 to tornadoes. These storms were also responsible for over 400 deaths and more than 8,000 injuries.

The year's worst tornadoes struck Blackwell, Okla., and Udall, Kans., on June 25, killing 100 persons and destroying property estimated at $10,225,000. The worst hailstorm caused $6,000,000 damage in Billings, Mont., and vicinity on July 6. During November and December several periods of high winds in the Northwest caused widespread damage. Damage in California alone during the period December 18 to 27 was estimated at $2,750,000. (From Climatological Data. National Summary, Annual 1955, Vol. 6. No. 13).

The Maps on pages 199, 200, 201, and 202, show the temperature and precipitation for the winter of 1954-55, spring, summer, and fall of 1955.

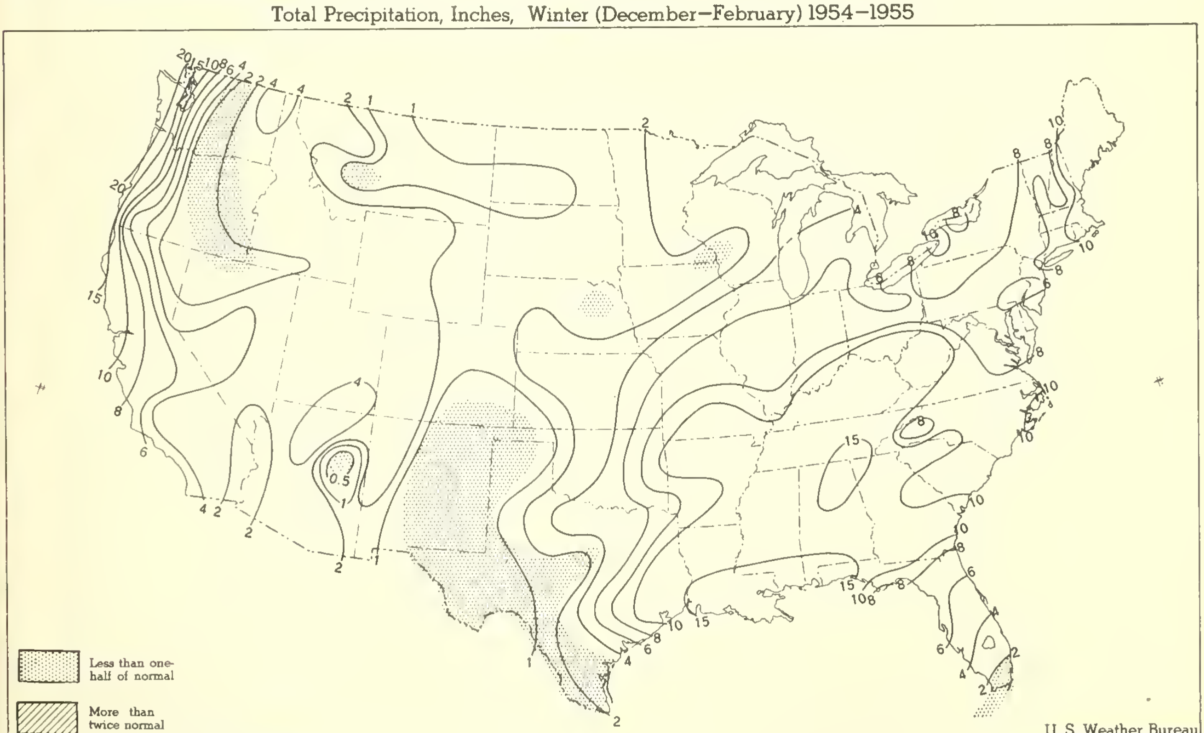
TEMPERATURE AND PRECIPITATION

Departure of Average Temperature from Normal (°F.), Winter (December–February) 1954–1955



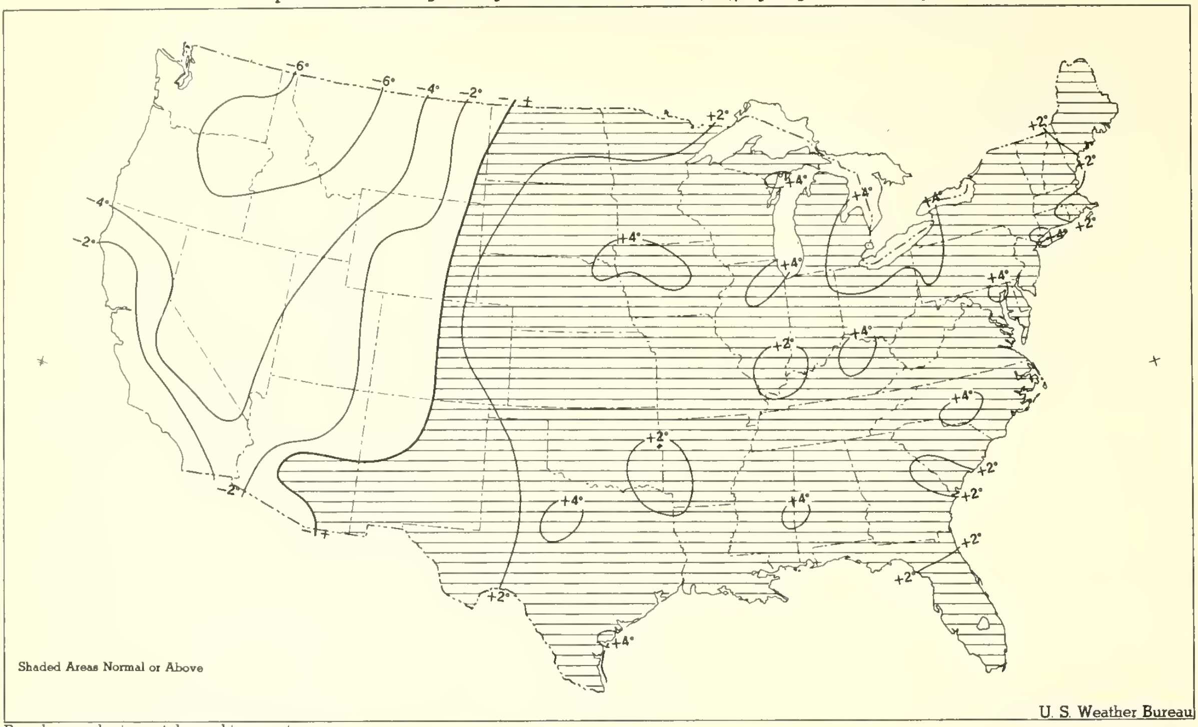
Based on preliminary telegraphic reports

Total Precipitation, Inches, Winter (December–February) 1954–1955



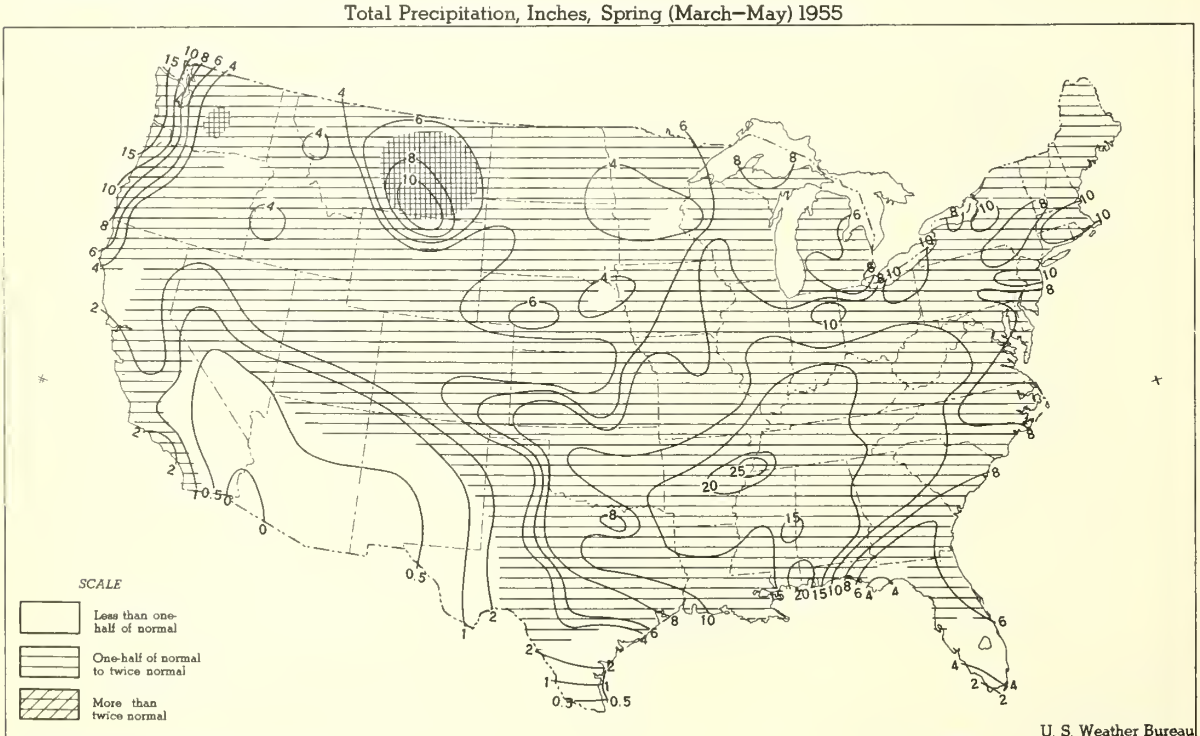
Based on preliminary telegraphic reports

Departure of Average Temperature from Normal (°F.), Spring (March–May) 1955



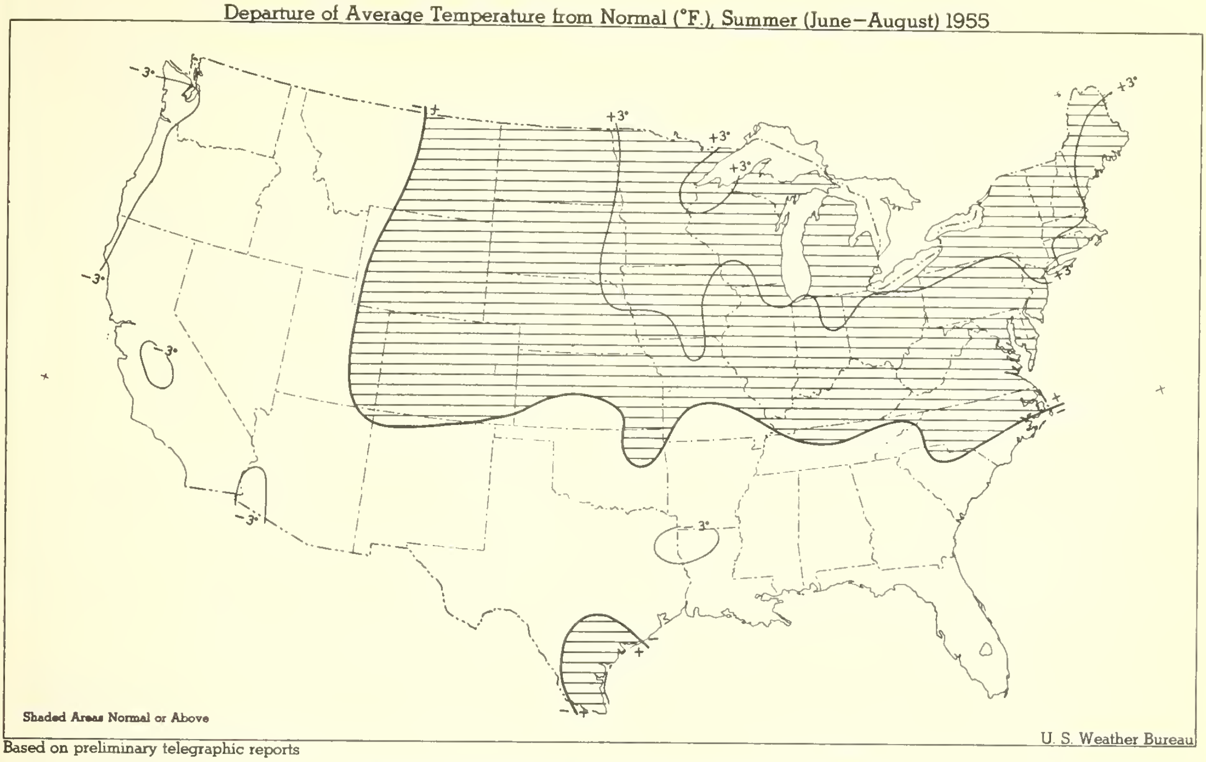
Based on preliminary telegraphic reports

Total Precipitation, Inches, Spring (March–May) 1955



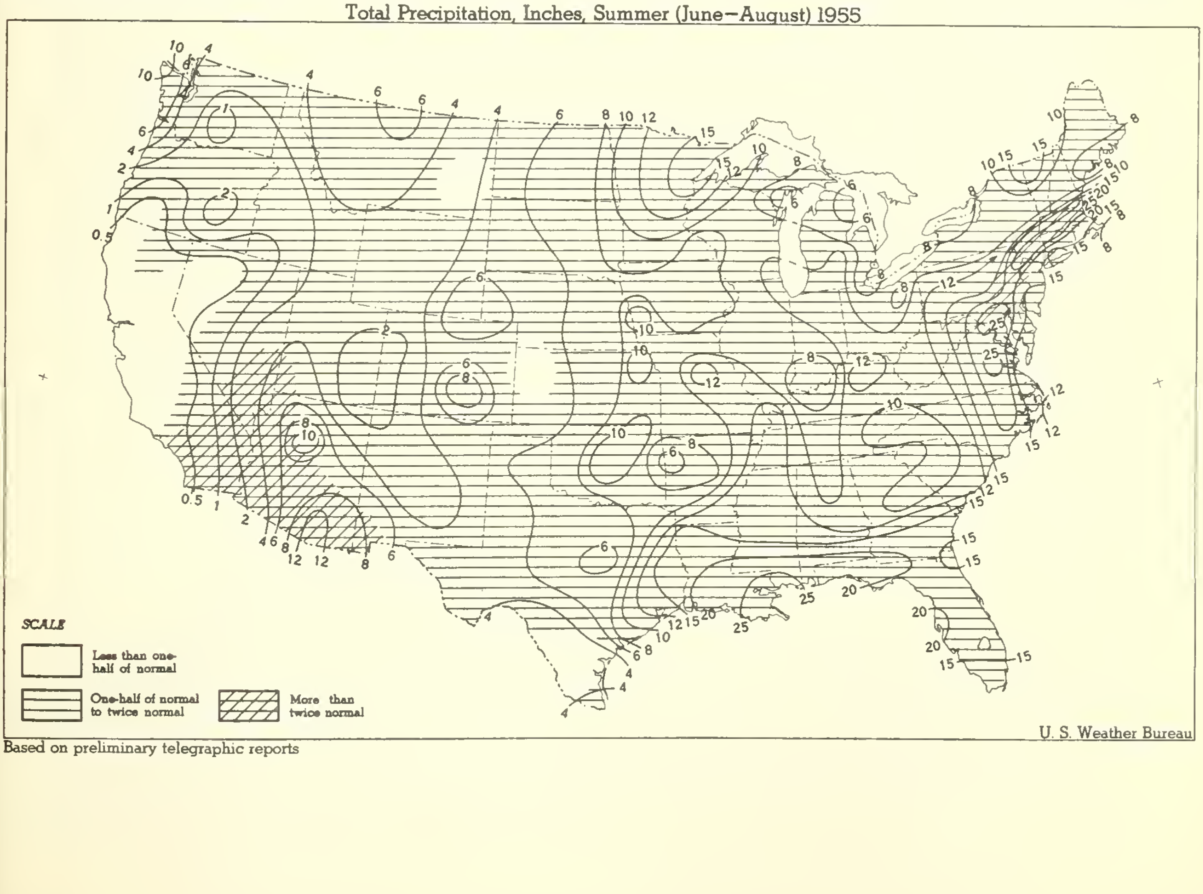
Based on preliminary telegraphic reports

Departure of Average Temperature from Normal (°F.), Summer (June—August) 1955



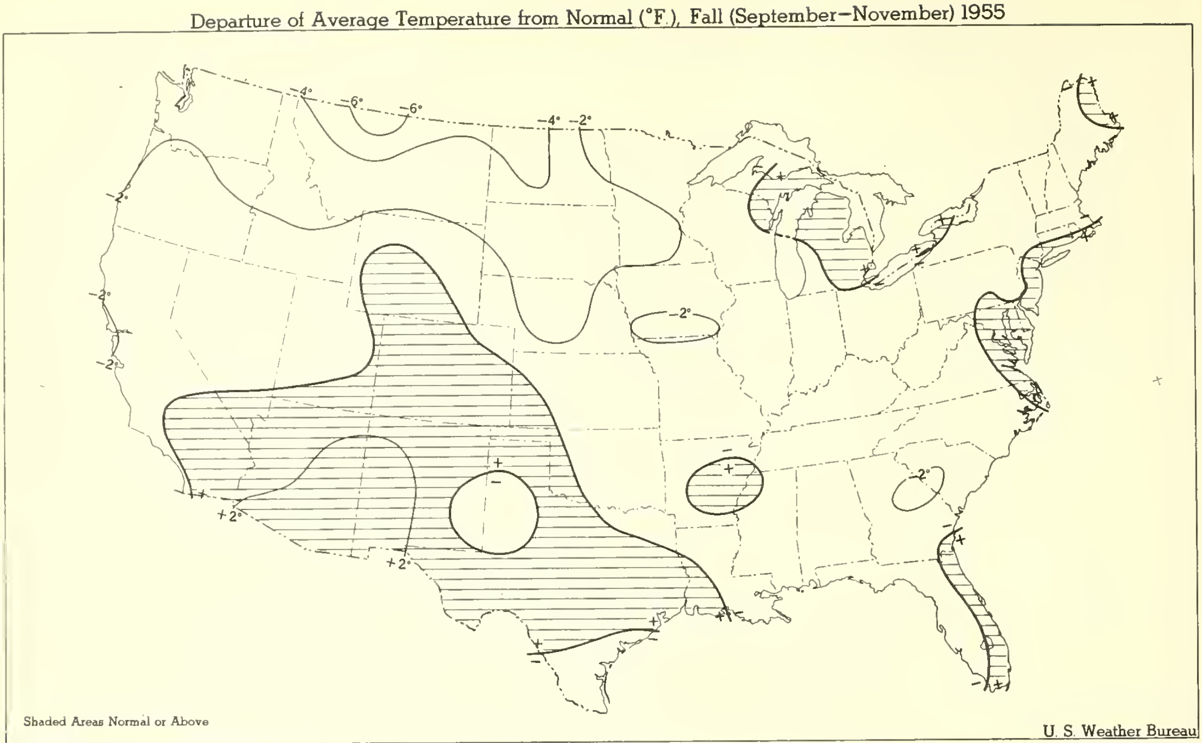
Based on preliminary telegraphic reports

Total Precipitation, Inches, Summer (June—August) 1955



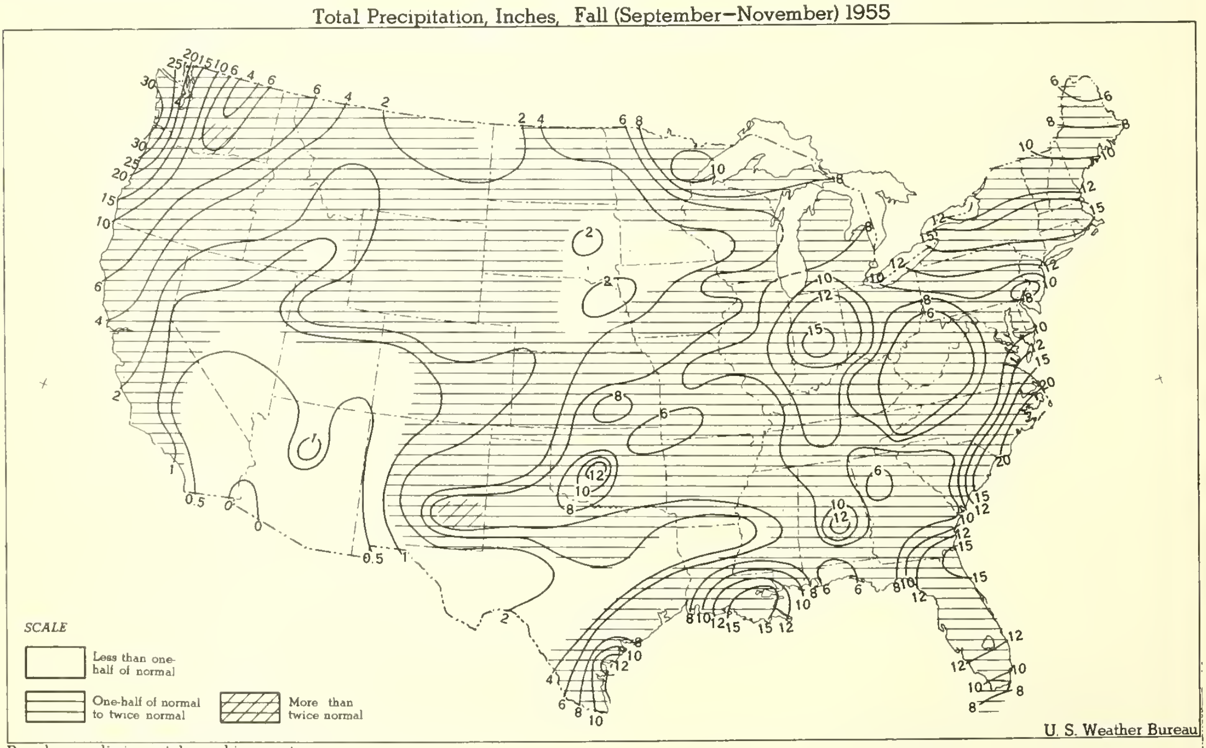
Based on preliminary telegraphic reports

Departure of Average Temperature from Normal (°F.), Fall (September–November) 1955



Based on preliminary telegraphic reports

Total Precipitation, Inches, Fall (September–November) 1955



Based on preliminary telegraphic reports

(From Weekly Weather and Crop Bulletin National Summary, Volume 42, 1955)

Table 1. Diseases reported in States where they had not been found or reported on a particular host until 1955[1, 2].

Host Disease (Cause)	Where found	Remarks
BARLEY (HORDEUM VULGARE)		
Downy mildew (*Sclerospora macrospora*)	Mississippi	Found on several varieties of barley (PDR 40: 258).
	Virginia	Destroyed 40 percent of wheat, oats and barley grains in a field in Henrico County (PDR 39: 695).
Leaf spot (Undetermined origin, possibly physiological)	Virginia	The distribution of the disease in the field suggested that the plants were absorbing from the soil a toxic residue produced by the woodland flora (PDR 39: 695).
OATS (AVENA SATIVA)		
Downy mildew (*Sclerospora macrospora*)	Virginia	See barley
WHEAT (TRITICUM AESTIVUM)		
Downy mildew (*Sclerospora macrospora*)	Mississippi	Found in two locations. (PDR 40: 258)
	Virginia	See barley
LEMON (CITRUS LIMONIA)		
Tristeza virus	Texas	This is the first report of the tristeza virus in Texas, though it is probable that it has been present on some Meyer lemon trees for over 25 years. (Proc. Rio Grande Valley Hort. Inst. 8: 84. 1954).

[1]Kilpatrick, R. A. and G. M. Dunn. Late season diseases on forage crops in New Hampshire in 1955. (PDR 40: 384). Many diseases were reported as being recognized in New Hampshire for the first time.

[2]Rogerson, Clark T. Diseases of grasses in Kansas: 1953-55 (PDR 40: 388). Seventeen fungi, previously unreported for Kansas, were found associated with grass diseases. In addition 30 new Kansas host records were obtained.

Host Disease (Cause)	Where found	Remarks
FIG (FICUS CARICA) Phomopsis cinerascens	Maryland	A very rare fungus on figs in the United States. Caused canker and die-back of a single fig tree at Cheverly, Maryland (PDR 39: 822).
PEACH (PRUNUS PERSICA) Zinc deficiency	Michigan	This is the first record for any of the Central States between the Alleghany and Rocky Mountains. (Mich. Agr. Exp. Sta. Quart. Bull. 38 (1): 70, 1955).
DOTTED SMARTWEED (POLYGONUM PUNCTATUM) Smut (Ustilago utriculosa)	Pennsylvania	Dotted smartweed seed is an important waterfowl food; occurs in almost pure communities in certain areas in Pennsylvania (PDR 40: 1017).
OLEANDER (NERIUM OLEANDER) Sphaceloma oleanderi	Florida	First record in the State. In the U. S., previously reported from Louisiana (PDR 40: 256).
LOBLOLLY PINE (PINUS TAEDA) Needle rust (Coleosporium laciniariae Arth.)	Virginia	Collected at Waynesboro in Augusta County (PDR 39: 695).
LOMBARDY POPLAR (POPULUS NIGRA var. ITALICA) Yellow leaf blister (Taphrina populina Fr.)	Virginia	Collected at Long Shop in Montgomery County (PDR 39: 695).
SUGAR BEET (BETA VULGARIS) Sugar beet nematode (Heterodera schachtii)	Oregon	Occurred in Umatilla County, one of the principal sugar beet producing areas of Oregon (PDR 40: 406).
EGGPLANT (SOLANUM MELONGENA) Verticillium wilt (Verticillium albo-atrum)	Florida	Observed on the organic and adjacent mineral soils of south Florida during the past two years (1954-1955) (PDR 40: 583).

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
POTATO (SOLANUM TUBEROSUM) Speck rot (Stysanus stemonites)	Virginia	The fungus appeared on the surface of cut potatoes held a few days in a moisture chamber (PDR 39: 695).

Table 2. Diseases found or reported in this country for the first time in 1955=*; diseases found on new hosts=**, [1, 2].

CORN (ZEA MAYS) (Curvularia maculans)	North Carolina Georgia	A new disease of corn. No previous report describing this fungus as a plant pathogen has been found in the literature (PDR 40: 210).
WHEAT (TRITICUM AESTIVUM) Stripe disease* (Cephalosporium gramineum)	Washington	A disease of winter wheat apparently previously unreported in the United States was observed on wheat during June and July of 1955. Found in five counties (Phytopath. 46: 178).
AGROPYRON INERNE A. TRACHYCAULUM A. TRICHOPHORUM BROMIS MARGINATUS Dwarf bunt** (Tilletia controversa)	Oregon Idaho Oregon Oregon	Dwarf bunt for many years was reported only on wheat in the U. S.; recently has been found on a number of forage grasses and rye. (PDR 40: 26).
PERENNIAL RYEGRASS (LOLIUM PERENNE) ITALIAN RYEGRASS (L. MULTIFLORUM) Dwarf bunt** (Tilletia controversa)	New York	The diseased ryegrass plants were growing among winter wheat plants in an experimental field nursery maintained for studies of dwarf bunt. (PDR 40: 508).

[1]Sprague, Roderick. Some leafspot fungi on western Gramineae. Mycologia 47: 835-845. 1955. Descriptions are given of new and noteworthy fungi collected chiefly in north-central Washington, Idaho, and the Rocky Mountains.

[2]Wilhelm, Stephen, Robert D. Raabe, and Eugene B. Smalley. Some previouslyunrecorded hosts of Verticillium albo-atrum in California (PDR 39: 693).

Table 2. (Continued).

Host Disease (Cause)	Where found	Remarks
DOWNY CHESS (BROMUS TECTORUM) HAIRY CHESS (B. COMMUTATUS) Bacterial blight (Xanthomonas translucens var. undulosa)**	Nebraska	Apparently a strain of the pathogen is involved which differs from that on wheat; greenhouse experiments indicated that the brome strain is weakly parasitic on cereals and is of minor importance in the development of Xanthomonas streak on the latter in the field. (PDR 39: 751).
ORCHARD GRASS (DACTYLIS GLOMERATA) Pleospora phaeocomes**	Pennsylvania	This hitherto undescribed disease of orchard grass has been under observation in Pennsylvania since 1953. First record of its presence in the United States (Phytopath. 45: 633).
LOTUS ULIGINOSUS Crown wart* (Physoderma potteri)	Oregon	The first diseased specimens were found in 1952 in a one-year old planting of L. uliginosus along the Tillamook River several miles inland from the Pacific Ocean. The disease appears to present an important new problem affecting utilization in wet locations of L. uliginosus, which has become a valuable forage legume (PDR 39: 749).
GOOSE-GRASS (ELEUSINE INDICA) LOVE-GRASS (ERAGROSTIS PECTINACEA) STINK-GRASS (ERAGROSTIS CILIANENSIS) (Crazy top** (downy mildew) (Sclerophthora macrospora)	Indiana	New hosts. Sporangia developed sparsely only on leaves of crabgrass (Digitaria sanguinalis). Sporangia were also found on a corn plant severely affected with crazy top (PDR 39: 839).
PEARL MILLET (PENNISETUM GLAUCUM) Top rot* (Fusarium moniliforme)	Georgia	First report of top rot (twisted top or Pokkah Boeng) on this host in the U.S. The disease has been reported on pearl millet in India (PDR 40: 387).
FIG (FICUS ELASTICA) Heterodera fici*	California	Collections from soil and root samples from a specimen of fig showing poor growth in a nursery at San Bernardino in November 1954 represent the first record of this nematode in the United States (PDR 40: 700).

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
HIGHBUSH BLUEBERRY (VACCINIUM CORYMBOSUM) New gall disease (Undetermined)	Massachusetts	Description given of a new disease affecting roots and branches of cultivated highbush blueberry (PDR 40: 212).
SWEET CHERRY (PRUNUS AVIUM) Microstroma tonellianum* **	Massachusetts	Originally described on plum leaves in Italy. A similar fungus has been reported on peach leaves in South Carolina, but not certain that it is the same species as the plum fungus. This appears to be the first report of this fungus on cherries, and the first report in North America (PDR 39: 697).
ALMOND (PRUNUS AMYGDALUS) Powdery mildew* (Podosphaera tridactyla)	California	Powdery mildew on almond seems to be uncommon (PDR 40: 584).
CALLISTEMON RIGIDUS HYDRANGEA sp. ILEX ROTUNDIFOLIA MAGNOLIA SOULANGEANA POINSETTIA PULCHERRIMA PYRACANTHA sp. RHODENDRON INDICA R. OBTUSA JAPONICUM Cylindrocladium scoparium**	Alabama	Reported as causing extensive losses of ornamental cuttings in propagation houses. Host range of the fungus extended to 8 new host species (PDR 39: 860).
CACTACEAE Helminthosporium stem rot (H. cactivorum)**	California	Application of captan together with eradication of diseased plants and soil sterilization gave control (Phytopath. 45: 509).
MAGNOLIA GRANDIFLORA Elsinoë magnoliae A. H. Miller and Jenkins	Southern United States	A new species of Elsinoë causing leaf scab. (Mycologia 47: 104).
RHODODENDRON Chrysomyxa ledi var. rhodendri*	Washington	First record of its appearance in the United States. Believed to have been introduced from Europe (PDR 39: 781).

Table 2. (Continued).

Host Disease (Cause)	Where found	Remarks
ASPEN (POPULUS TREMULOIDES) Sooty-bark canker* ** (Cenangium singulare (Rehm) Davidson and Cash)	Colorado	Described here for the first time, reported from the central Rocky Mountains. Occurs at various heights on the trunk. Most abundant on diseased bark of killed trees (Phytopath. 46: 34).
HONEYLOCUST (GLEDITSIA TRIACANTHOS) Cankers and rot** (Poria spiculosa)	Mississippi Tennessee	White heart rot was also associated with these cankers (Jour. Forestry 52: 941).
LODGEPOLE PINE (PINUS CONTORTA) Dwarfmistletoe** (Arceuthobium vaginatum f. cryptopodum)	Colorado	Dwarfmistletoe kills some lodgepole pines, but is of no practical importance on the tree. Apparently first report on this host (PDR 40: 252).
MIMOSA (ALBIZZIA JULIBRISSIN) Stubby-root nematode** (Trichodorus primitivus)	Maryland	Trichodorus sp. has previously been reported from Maryland, but this is the first report of T. primitivus. Apparently no other hosts of this species have been recorded (PDR 40: 259).
PERSIMMON (DIOSPYROS spp.) Citrus-root nematode** (Tylenchulus semipenetrans)	California	Found in November 1955 attached to field grown persimmon roots, including D. lotus seedlings and D. lotus rootstock with scions of the Hachiya variety. (PDR 40: 276).
PERSIMMON (DIOSPYROS LOTUS) Elsinoë diospyri* **	Florida	Additional host and first U. S. record. (PDR 40: 256).

Table 2. (Continued).

Host Disease (Cause)	Where found	Remarks
COTTON (GOSSYPIUM SPP.) Bacteriophage of *Xanthomonas malvacearum*	Texas New Mexico	A bacteriophage attacking *Xanthomonas malvacearum* of cotton was isolated at College Station, Texas, from dried diseased leaves, apparently for the first time in the United States. Observations suggest that bacteriophage isolates from Texas and New Mexico may prove useful in the identification of strains of the bacterium occurring throughout the cotton belt. (Phytopath. 45: 454).
SESAME (SESAMUM INDICUM) Aerial stem rot* (*Helminthosporium sesami*)	Texas	Apparently not previously reported from the U. S. The disease was found attacking almost mature plants of the variety Guacara in the breeding nursery near College Station, in 1954 (PDR 40: 235).
SUGARCANE (SACCHARUM OFFICINARUM) Root-knot nematode** (*Meloidogyne incognita* var. *acrita*)	Louisiana	(PDR 40: 406).

GENERAL

J. O. Andes reported estimated loss from plant diseases of major importance in Tennessee in 1955 (PDR 40: 162).

Results of a survey to determine occurrence of plant parasitic nematodes in Louisiana soils were reported by Fielding and Hollis. A total of 461 samples from 13 major crop plants was analyzed and the results given in a table. The breakdown included the number of samples, names of the parasitic nematodes for each crop plant, and the percentage of samples infested with a particular nematode. Species of the genus *Pratylenchus* were most common among the parasitic nematodes found in the Louisiana soil surveyed (PDR 40: 403).

U. R. Gore and others comment on the diseases of barley, oats, rye and wheat in Georgia in 1955 (PDR 40: 224).

J. O. Andes reported estimated loss from plant diseases of major importance in Tennessee in 1955 (PDR 40: 162).

G. B. Cummins and R. M. Caldwell discuss nomenclature in the leaf rust fungus (Puccinia spp.) complex of cereals and grasses (Phytopath. 46: 81).

Results of the 1954 cereal seed-treatment trials in Michigan were reported by Kiesling and Grafius. In the annual seed treatment trials wheat naturally infested with bunt (Tilletia foetida) and oats inoculated with smut (Ustilago avenae and U. kolleri) were treated with 16 different fungicides. Dusts gave poor control of bunt owing to the heavy spore load, and the results indicated the importance of cleaning grain before treating. Slurry and liquid treatments gave much better control through better coverage (Mich. Agr. Exp. Sta. Quart. Bull. 37: 457-460. 1955).

R. W. Leukel summarized results of the 1954-55 tests of seed treatment materials for the control of oat loose smut (Ustilago avenae) and wheat bunt (Tilletia sp.). He included some data on the amount of seed treated before planting (PDR 39: 647).

Results of the 1955 cooperative seed treatment trials were reported by J. E. Machacek. A comparison was made, under experimental plot conditions at 25 stations, of the effectiveness of a number of recently introduced seed dressings against the surface-borne smuts of wheat, oats, and barley, and against seed rot of flax. All the products tested were effective against bunt of wheat, and most of them against seed rot of flax (PDR 40: 33).

Various cereal and forage crop plants and grasses, as well as other monocotyledonous and dicotyledonous plants, were inoculated to determine their reaction to the yellow strain of wheat mosaic virus, Marmor virgatum var. typicum. Of the crop plants tested only wheat and certain millets were susceptible enough to be damaged severely by the disease. Many varieties of corn were immune in these tests. (W. H. Sill, Jr. and P. C. Agusiobo, PDR 39: 633).

Transmission experiments with the Washington strain of the cereal yellow-dwarf virus indicated that the apple-grain aphid (Rhopalosiphum fitchii) is a more efficient vector than the English grain aphid (Macrosiphum granarium), and also that the virus components transmitted by each species were not the same, according to H. V. Toko and G. W. Bruehl (PDR 40: 284).

Weather injuries. H. R. Rosen described the severe injury to small grains in Arkansas that resulted from sudden freezing weather in late March 1955. (PDR 40: 30).

AVENA SATIVA. OATS: Investigations on the microflora associated with oats in storage and collected in the field in Illinois were reported by S. A. Ostazeski and Wayne M. Bever (PDR 39: 591).

D. C. Arny compared results from seed-treatment materials applied to oats in laboratory studies and with commercial treating machines (PDR 40: 364).

Puccinia coronata var. avenae, crown rust. The distribution and relative prevalence of the physiologic races of oat crown rust identified in 1955 are listed (M. D. Simons, PDR 40: 810).

Oat mosaic virus was severe in 1952-53, and even more so in 1954-55, in an autumn-sown oat nursery in Beaufort County, South Carolina. Approximately a third of the 29 named varieties and of the 48 unnamed selections included in three nurseries were rated as being too susceptible for safe growing on infested soil. Wheat varieties and selections grown in the same nursery showed no signs of infection (S. J. Hadden and H. F. Harrison, PDR 39: 628).

H. H. McKinney described a virus from orchard grass (Dactylis glomerata) that infects oats. Limited tests showed that the virus infects some varieties of oats, and that the virus from oats infects orchard grass (PDR 40: 524).

HORDEUM VULGARE. BARLEY: R. E. Ohms reported a phycomycetous mycorrhizal fungus found on barley roots in South Dakota (PDR 40: 507).

In Colorado, R. H. Porter reported seed treatments for stripe (Helminthosporium gramineum) and covered smut (Ustilago hordei) of barley. In 1955, Merlane, Merculine, and Panogen controlled covered smut effectively without significantly increasing or decreasing the yield in comparison with the checks (PDR 40: 112).

Puccinia graminis tritici, stem rust. Adequate resistance to race 59A of stem rust was found among more than 1200 spring barley lines screened for resistance by J. D. Miller and J. W. Lambert (PDR 40: 340).

Antibiotics were included among materials tested by R. H. Porter for control of barley loose smut, Ustilago nuda (PDR 40: 106). U. nuda remained viable in barley seed embryos for 11 years in one proved instance reported by R. H. Porter from Colorado. (Phytopath. 45: 637.

Pyrenophora teres, net blotch. Studies at the University of California, reported by C. W. Schaller, showed that inheritance of resistance of the Tifang variety to net blotch is controlled by a single gene pair, and that resistance is incompletely dominant. (Phytopath. 45: 174).

H. H. McKinney reported studies with dual infections by different strains of barley stripe-mosaic virus and by the viruses of barley stripe mosaic (PDR 40: 520).

W. H. Sill and E. D. Hansing discussed the distribution and importance of barley stripe mosaic in Kansas where two strains of the virus have been found. Some fields suffered severe losses. (PDR 39: 670). The time of infection by the barley stripe mosaic virus affected symptom expression, yield and seed infection, according to R. F. Eslick and M. M. Afanasiev in Montana (PDR 39: 722).

Allen and Houston reported the results of a survey concerning the distribution of the barley yellow-dwarf virus. It was found to be widely distributed in California, and was shown to be present in specimens from 8 additional States, as follows: Arizona, Arkansas, Illinois, Maryland, Minnesota, Oregon, Washington and Wisconsin. (PDR 40: 21).

LINUM USITATISSIMUM. FLAX: In California, Knowles and Houston reported the inheritance of resistance to Fusarium wilt (F. oxysporum f. lini) of flax in Dakota selection 48-94. (Jour. Agron. 47: 131).

ORYZA SATIVA. RICE: Piricularia oryzae, blast. According to J. G. Atkins rice blast had almost disappeared in the Gulf Coast area in recent years, but an outbreak in 1955 demonstrated its potential importance again (PDR 40: 373).

Tylenchorhynchus martini, stylet nematode. J. G. Atkins and M. J. Fielding concluded that the marked improvement of rice yields resulting from soil fumigation for stylet nematode control may be due to the effect of the chemicals upon a nematode-root rot complex (PDR 40: 488).

SORGHUM VULGARE. SORGHUM: C. H. Hsi described the different types of stalk rots of sorghum prevalent in eastern New Mexico in 1955, including Colletotrichum and Fusarium stalk rots newly recognized in the State (PDR 40: 369).

Rhizopus oryzae was reported by R. H. Porter as the cause of severe injury to sorghum seed in Colorado. Results of three control tests were summarized (PDR 40: 141).

Sphacelotheca sorghi, covered kernel smut. R. W. Leukel reported sorghum seed-treatment tests in 1955. The superiority of Phygon compared with mercurials and with other nonmercurials in controlling covered kernel smut in Rancher sorgo, especially with the heavier applications, indicates that it is the logical choice as a seed disinfectant for sorghum seed with persistent glumes (PDR 40: 138).

TRITICUM AESTIVUM. WHEAT: In Illinois, B. Koehler and W. M. Bever reported results of investigations on toxicity of various chemicals to wheat seed and on the effect of storage temperature on injury to treated seed (PDR 40: 490).

Aspergillus restrictus. In grain storage studies, C. M. Christensen reported mold invasion of wheat stored for 16 months at moisture contents below 15 percent. A. repens and A. ruber were prevalent at 14.5 to 15 percent. (Cereal Chem. 32: 107).

Cephalosporium gramineum, stripe. In Washington, G. W. Bruehl described symptoms of the prematurity blight phase of Cephalosporium stripe disease of wheat as observed in greenhouse experiments in 1955. (PDR 40: 237).

Erysiphe graminis tritici, powdery mildew. Willard Crosier and Michael Szkolnik reported that Acti-dione was inferior to sulfur and Karathane for control of wheat powdery mildew in greenhouse experiments in New York (PDR 40: 337).

According to C. H. Hsi, dryland root rot was widespread in eastern New Mexico in 1955 for the third consecutive year. Root rot organisms commonly isolated from the diseased plants included Helminthosporium sativum, Rhizoctonia solani, Fusarium spp., and Curvularia spp. (PDR 40: 361).

Puccinia spp., rust. Leaf rust (P. rubigo-vera var. tritici) was rare in Kansas the fall of 1954, both on spore trap slides and in the field, whereas stem rust (P. graminis var.

tritici) was relatively abundant. Conditions were unfavorable for overwintering of stem rust and, with few exceptions, this was true also for leaf rust. The loss from leaf rust for the State was estimated at 1 percent. High temperatures and low rainfall effectively checked stem rust development and the average loss was only a trace (S. M. Pady and C. O. Johnston, PDR 40: 882). Johnston, and Levine published the fifth revision of the international register of physiological races of leaf rust of wheat, which adds 31 more races, bringing the total to 163. A tabulated summary shows the author and year of publication of all races described to date (PDR Suppl. 233, pp. 104-120). In Nebraska Aristeo Acosta and J. E. Livingston reported the effects of calcium sulfamate and sodium sulfanilate on small grains and on stem rust development. Injury to wheat from calcium sulfamate was found to depend on the stage of growth at which the treatments were given. Yields were reduced only by applications at tillering, and germination was impaired by applications following pollination. Treatment with sodium sulfanilate a week after tillering and 6 days after flowering resulted in a significant increase in yield (Phytopath. 45: 503).

Tilletia controversa, dwarf bunt. Depth of seeding of wheat and the critical environmental factors in relation to the incidence and germination of dwarf bunt spores were reviewed by J. P. Meiners and others. Dwarf bunt was most prevalent where the seed was planted at or near the surface level of the soil. As the depth of seeding was increased up to 4 inches the percentage of infection decreased (PDR 40: 242).

Tilletia spp, bunt. R. W. Newburgh and V. H. Cheldelin reported that of the ten antibiotics tested in Oregon, oligomycin alone resulted in a 100 percent inhibition of the in vitro growth of T. caries (PDR 39: 684). Results achieved in the control of wheat bunt (Tilletia foetida) and the history of the disease in Kansas during the past 42 years were discussed by L. E. Melchers and others (PDR 40: 493).

Wheat streak mosaic virus. F. H. McNeal and A. L. Dubbs reported losses from wheat streak mosaic in Montana in 1955 (PDR 40: 517). Hurley Fellows gave directions for the construction of equipment to facilitate study of the mite vector (Aceria tulipae) of wheat yellow streak mosaic virus (PDR 40: 601).

ZEA MAYS. CORN: L. E. Melchers reported studies on the fungi isolated from Kansas-grown hybrid seed corn, 1952-1954. Fusarium moniliforme was by far the most prevalent but is not considered important in Kansas. (PDR 40: 500).

Bacterium stewartii, Stewart's wilt, bacterial wilt. Results of corn seed treatment with various antibiotics, growth regulators, and other chemicals to control the disease were reported by Saul Rich in Massachusetts (PDR 40: 417). Bacterial wilt was predicted by G. H. Boewe in his seventh forecast to be less destructive in 1955 and not to occur so far north in Illinois as it did in 1953 or 1954. Entomological research in Illinois in 1954 indicated that dieldrin is very effective in controlling the corn flea beetles in which the organism overwinters. Forecasting of bacterial wilt incidence is based upon the close relationship that appears to exist between the amount of disease which develops during the summer and the temperature of the preceding winter, but other, unknown, factors may affect the accuracy of the prediction. For example, in 1954 early season wilt was much less severe than expected except in localized areas. (PDR 39: 384).

Fusarium moniliforme, mold. As part of a cooperative study investigating the effect of feeding moldy corn to swine, Nelson and Osborne reported that an extensive survey was made to determine the relative prevalence and geographic distribution of fungi associated with moldy corn. One or more samples of moldy corn were obtained from each of 26 counties in eastern North Carolina. The survey indicated that F. moniliforme was the most widespread and prevalent fungus on moldy corn (PDR 40: 225). (See also L. E. Melchers' report above.)

Gibberella zeae, stalk rot. Raymond Cappellini reported on the incidence and percentage of stalk rot of corn in New Jersey in 1955. Percentage infection ranged from 0 to 35, with an average of 10 percent. G. zeae was isolated most frequently (average 69 percent) (PDR 40: 244).

Investigations on control of the Helminthosporium blight diseases (H. turcicum and H. maydis) on sweet corn in Florida were reported by R. S. Cox (Phytopath. 46: 112).

In Iowa, A. L. Hooker reported that corn seedling resistance to Pythium appeared to be effective against several Pythium species (Phytopath. 46: 175).

Nematodes. Root growth was better and ears were larger in plots of corn treated for control of parasitic nematodes (Tylenchorhynchus sp., Trichodorus sp., Pratylenchus zeae) (J. Y. Oakes and others, PDR 40: 853). During a 1955 survey in Maryland 25 genera of known or suspected plant-parasitic nematodes were found on corn, tobacco, and soybean, according to W. R. Jenkins and others (PDR 40: 37). Susceptibility to attack by the stunt nematode (Tylenchorhynchus claytoni) seems dominant to resistance in corn, according to studies reported by R. R. Nelson in North Carolina (PDR 40: 635).

ZEA MAYS var. SACCHARATA. SWEET CORN: Bacterium stewartii, bacterial wilt. J. L. Lockwood and L. E. Williams reported results of field tests with antibiotics and Tween 20 for the control of bacterial wilt. Corn flea beetles (Chaetocnema pulicaria) were abundant at Wooster and Marietta, Ohio at emergence of the corn and throughout the growing season. Most diseased plants in 1955 grew and produced marketable ears (PDR 40: 622).

DISEASES OF FORAGE AND COVER CROPS

Prevalence and importance of diseases of forage crops in New York in 1955, with estimates of crop losses, were reported by D. A. Roberts and others (PDR 40: 219).

R. A. Kilpatrick and G. M. Dunn reported late season diseases on forage crops in New Hampshire in 1955. Many of the diseases were recognized in New Hampshire for the first time (PDR 40: 384).

The frequent occurrence of plant parasitic nematodes in samples from 368 fields of cover, pasture, and forage crops in Maryland was reported by W. R. Jenkins and others. The most frequently found genera of plant parasites were Xiphinema, Pratylenchus, and Tylenchorhynchus (PDR 40: 184).

GRASSES

AGROPYRON TRACHYCAULUM. SLENDER WHEATGRASS: Tilletia controversa, dwarf bunt. In the Pacific Northwest Jack P. Meiners reported that in a recent series of inoculations slender wheatgrass became infected with dwarf bunt from wheat. Apparently this is the first report of a grass being found susceptible to wheat dwarf bunt by inoculation. The same inoculation procedure and inoculum also resulted in infection on Orin wheat (PDR 40: 347).

ANDROPOGON GERARDI, BIG BLUESTEM: Aecidium aesculi, buckeye rust was known only from Kansas and Nebraska until 1952, when it was collected on Aesculus glabra in Iowa. Observations made in the area by J. W. Baxter indicated a possible connection between the Aecidium on Aesculus and Puccinia andropogonis on big bluestem. Aeciospores of Aecidium aesculi were used to inoculate young plants of A. gerardi grown from seed in the greenhouse. Uredia of P. andropogonis appeared on all the inoculated plants from 7 to 10 days after inoculation (PDR 39: 658).

Sphacelotheca occidentalis, kernel smut. J. Dunleavy stated that this disease has been reported only from the United States and Canada. It causes severe stunting. The smut overwinters in the rhizomes of infected plants, which deteriorate and die in a few years. A histological examination of plants taken as sods from local pastures or grown from seed harvested in Nebraska disclosed the presence of hyphae throughout the parenchyma cells of the rhizomes, stems, and flowers, but not in the meristematic zones (Phytopath. 46: 116).

BROMUS INERMIS. SMOOTH BROME GRASS: A severe outbreak of brome mosaic virus affected many clones of smooth brome grass in the grass breeding nursery at Kansas State College in 1955. In a small 3-year-old nursery 116 out of 650 plants were infected. The wide distribution of the virus in Kansas and the severity of the disease on several other small grains and grasses after artificial inoculation indicate its potential importance. Every effort should be made to check its spread and eliminate it from breeding nurseries (W. H. Sill and R. C. Pickett, PDR 39: 802).

POA PRATENSIS. KENTUCKY BLUEGRASS: Puccinia graminis, rust. During the 1955 growing season, rust of Merion bluegrass was epiphytotic in many areas of Pennsylvania, according to H. B. Couch and Herbert Cole, Jr. Five compounds tested provided some measure of control. Acti-dione was most satisfactory, followed by a Dithane-zinc-copper formulation. Both were phytotoxic (PDR 40: 103).

STENOTAPHRUM SECUNDATUM. ST. AUGUSTINE LAWN GRASS: Lawns of St. Augustine grass in Mobile, Alabama suffered severe damage from a species of Physalospora, according to R. L. Self and C. H. Driver (PDR 40: 509).

LEGUMES

J. W. Baxter reported incidence of forage legume diseases in Iowa in 1955 (PDR 40: 217).

In tests conducted in Iowa to determine the relative toxicity of legume seed protectants to Rhizobium spp., Ceresan M was found to be highly toxic, Arasan and Arasan SF were intermediate, and Spergon and wettable Spergon showed very low toxicity. R. meliloti was somewhat less sensitive to all fungicides than R. japonicum. It was thought that Ceresan M and higher dosages of Arasan and Arasan SF may prove to be sufficiently toxic to R. meliloti and R. japonicum to inhibit nodulation (G. W. Peterson and W. F. Buchholtz, Iowa State Coll. Jour. Sci. 29(1): 95.

CYAMOPSIS TETRAGONOLOBA. GUAR: Yarwood and Gold stated that of the various hosts tested at the University of California for reaction to potato virus S only guar showed symptoms. Examination by the electron microscope of sap extracted from lesions revealed rod-shaped particles typical of potato virus S (PDR 39: 622).

GLYCINE MAX. SOYBEAN: Heterodera schachtii var. trifolii, clover cyst nematode. From tests with an Illinois population of the clover cyst nematode Mankou and Linford concluded that none of the 27 soybean varieties exposed to infestation would be likely to support a population of this nematode (PDR 40: 39).

Meloidogyne arenaria, root knot. M. D. Whitehead and others reported severe root-knot nematode infection of the soybean variety Lee in Dunklin County, Missouri (PDR 40: 176).

During a 1955 survey in Maryland 25 genera of known or suspected plant-parasitic nematodes were found on corn, tobacco, and soybean, according to W. R. Jenkins and others (PDR 40: 37).

R. P. Kahn and F. M. Latterell reported symptoms of bud-blight of soybeans caused by the tobacco- and tomato-ringspot viruses. This is believed to be the first record of the tomato ring spot virus as an agent of bud blight in soybean (Phytopath. 45: 500).

MEDICAGO SATIVA. ALFALFA: Colletotrichum trifolii, anthracnose. D. C. Erwin, reporting important diseases of alfalfa in southern California, stated that anthracnose on stems and crowns of alfalfa was found for the first time in three southern California counties (PDR 40: 380).

TRIFOLIUM SPP. CLOVER: C. M. Leach reported that an improved method for the isolation of pathogens from clover and other small-seeded legumes had been devised at the Oregon Agricultural Experiment Station (Phytopath. 45: 94).

TRIFOLIUM PRATENSE. RED CLOVER: According to J. W. Gerdemann Polymyxa graminis was found in 1955 in red clover roots collected from a field on the Agronomy South Farm at Urbana, Illinois. The abundance of spore clusters indicated that the fungus may cause injury to the roots under certain conditions (PDR 39: 859).

TRIFOLIUM PRATENSE. RED CLOVER: In Kentucky, symptom reaction of individual red clover plants to yellow bean mosaic virus was reported by S. Diachun and L. Henson (Phytopath. 46: 150).

TRIFOLIUM REPENS var. LADINO. LADINO CLOVER: A comparison of results from greenhouse and field inoculations of Ladino clover with Sclerotinia trifoliorum was reported by A. A. Hanson and J. H. Graham in Pennsylvania (Agron. Jour. 47: 280).

DISEASES OF FRUIT CROPS

J. O. Andes reported estimated loss from plant diseases of major importance in Tennessee in 1955 (PDR 40: 162).

K. G. Parker and W. F. Mai reported that the root lesion nematode, Pratylenchus penetrans, apparently is a major factor in failure of tree fruits on light soils in western New York. Sour cherry was most severely affected but there was evidence of substantial damage to apple trees and moderate damage to peach trees. The nematode occurred in association with other tree fruits also. Some other nematodes were found in orchard soils, including Xiphinema sp., Criconemoides sp., and Paratylenchus sp. (PDR 40: 694).

CITRUS Spp. CITRUS: A stable inexpensive wax emulsion for waxing citrus fruits, referred to as 101A, is fungicidal. It contains Dowicide A and hexamine. In Florida, Valencia oranges picked in April and May, treated and stored at 70°F showed 78, 76, and 42 percent reduction in decay after 1, 2, and 3 weeks, respectively. The emulsion is also satisfactory on grapefruit and is particularly suitable for the more tender citrus varieties such as Temple oranges and tangerines (Proc. Amer. Soc. Hort. Sci. 66: 164).

T. A. DeWolfe and others reported that two nematode-capturing fungi, Arthrobotrys oligospora and A. dactyloides, were found in a shavings mulch applied experimentally in a citrus grove in California. Among the nematodes devoured was the citrus nematode, Tylenchulus semipenetrans (Calif. Citrogr. 39: 104).

Wray Birchfield and F. Bistline reported studies on the probable effect of different cover crops on the recurrence of the burrowing nematode (Radopholus similis) in citrus spreading decline control areas in Florida (PDR 40: 398).

Phytophthora parasitica, brown rot. It is not known whether the recent important occurrence in Florida of brown rot of citrus fruit on the tree is associated with weather or with the possible introduction of fruit-infecting strains of P. parasitica (L. C. Knorr, PDR 40: 772).

Viruses.

Tristeza. J. B. Carpenter reported identification of tristeza in Meyer lemon in Arizona. The survey was begun in October 1955 (PDR 40: 701).

J. M. Wallace and others discussed the origin and spread of citrus viruses, especially tristeza. Attention was given to the need for international exchange of plant material, the dangers of distributing viruses in such material, and ways of lessening these dangers.

A bud union abnormality possibly caused by a virus or virus complex was reported by G. R. Grimm and others to be very common in Florida on rough lemon rootstocks with sweet orange scions, being particularly severe during the dry months of March to May. The symptoms resembled those of cachexia disease (PDR 39: 810).

Transmission experiments and xyloporosis-cachexia relations in Florida were reported by J. F. L. Childs. The effect on citrus budwood certification programs of the possibility of transmission of the xyloporosis virus through seed of sweet lime was stressed by the author (PDR 40: 143).

ERIOBOTRYA JAPONICA. LOQUAT: In Alabama, experimental results reported by R. L. Self and H. S. Ward Jr. showed that one-sided growth of loquat seedlings in cans results from high soil temperatures on the side exposed to the sun (PDR 40: 957).

FICUS CARICA. FIG: At the Citrus Experiment Station, Riverside, California, fig mosaic virus was found to be transmitted by the eriophyid mite, Aceria ficus, according to Flock and Wallace (Phytopath. 45: 52).

FRAGARIA Spp. STRAWBERRY: Dormancy is a factor in the tolerance of strawberry plants to hot-water treatment, according to A. C. Goheen and others (PDR 40: 446).

Edward K. Vaughan and others described the Oregon strawberry plant propagation center (PDR 40: 322).

Botrytis cinerea, gray mold, In greenhouse trials thiram and dichlone gave good control of gray mold of strawberries for 18 days after spraying. Thioneb, Mesulfane and Norsulfane at the higher concentration gave good control for 10 days. Captan gave moderate control for 10 days. Three other chemicals tried proved unsatisfactory (Stoddard and Miller, PDR 40: 443).

Nematodes. In Louisiana the occurrence and pathogenicity of nematodes in commercial strawberry areas, and effects of soil fumigation on nematode populations and on fruit yields were investigated (N. L. Horn and others, PDR 40: 790).

A. C. Goheen and A. J. Braun furnished data indicating that many nematodes that can parasitize wild strawberry plants are widely distributed in wooded areas in Maryland. Because these woodland areas are located in regions where cultivated crops may have been grown a century or two earlier and also because nematodes may have been carried by water or by animals from nearby cultivated land, it was not possible to state definitely that these nematodes are indigenous. However, since meadow (Pratylenchus penetrans), ring (Criconemoides sp.), dagger (Xiphinema sp.), and spiral (Helicotylenchus nannus) nematodes were found in four to seven of the 12 wooded areas investigated, circumstantial evidence suggested that these four nematodes at least are indigenous in Maryland (PDR 40: 43).

Richard A. Chapman recorded the plant parasitic nematodes associated with strawberries in Kentucky. During September and October 1955, 50 strawberry fields in 18 counties were systemically sampled to determine the nematode populations associated with this crop (PDR 40: 179).

Root-knot nematode. The effectiveness and mode of use of Nemagon for the control of Meloidogyne hapla was outlined by H. S. Potter and O. D. Morgan (PDR 40: 187). John S. Bailey reported observations suggesting that root-knot nematodes in strawberry roots do not persist in Massachusetts (PDR 40: 44).

Pratylenchus penetrans, meadow nematode, can enter strawberry roots directly and feed and reproduce itself therein, thus proving that it is a primary parasite of strawberry. Inoculations with large numbers of this nematode produced marked stunting of the plants. Plants set in soil infested with this nematode did not survive and grow so well as plants set in nematode-free soil. The roots of plants from nematode-infested soil were badly rotted and showed typical black root rot symptoms, whereas those from nematode-free soil were almost free of rot (A. C. Goheen and J. B. Smith, PDR 40: 146). Observations reported by D. J. Raski indicated that Pratylenchus penetrans is only one of the factors associated with black root rot in the California strawberry planting studied (PDR 40: 690).

In California, Stephen Wilhelm reported Verticillium wilt (Verticillium albo-atrum of strawberry with special reference to resistance (Phytopath. 45: 387).

Black root rot. Vapam and ethylene dibromide plus Terrachlor, treatments having both nematocidal and fungicidal properties, gave better control of black root rot of strawberries than either nematocides or fungicides used alone. Control by either type of treatment alone was only intermediate as compared to that given by a combination treatment (Patrick M. Miller, PDR 40: 45).

Viruses.

The symptoms produced in Fragaria vesca by a combination of strawberry viruses was discussed by John R. McGrew (PDR 40: 173).

In New Hampshire, during the 1954 and 1955 growing season a comparison was made between virus-free and locally grown commercial strawberry plants with reference to plant production and fruit yield. The average numbers of runner plants produced per mother plant in 1954 for the virus-free Catskill, Premier, and Sparkle were 89, 160, and 95, respectively, and for the commercial plants 39, 93, and 81. Yield data were taken in 1955. The average yields per clone for the virus-free Catskill, Premier, and Sparkle were 10.6, 13.5, and 10.9 quarts, respectively, as compared to 3.9, 8.0 and 7.2 quarts for the locally grown commercial plants. The greater fruit yield of the virus-free clones of each variety seemed to be due to a larger number of plants produced in these clones than to more or larger berries per plant (R. F. Becker and A. E. Rich, PDR 40: 947).

MALUS SYLVESTRIS. APPLE: Captan and zineb in combination was the most satisfactory general purpose spray for the control of apple diseases, in Delaware tests reported by J. W. Heuberger and others (PDR 40: 467).

J. C. Dunegan and R. W. Wilson reported evidence indicating downward diffusion of streptomycin in apple and pear tissues (PDR 40: 478).

Botryosphaeria ribis, canker and fruit rot, has been found in New York according to G. D. Lewis. Observations on varietal susceptibiltiy in southern New York were discussed. The progress of decay in Red Delicious fruits was described (PDR 40: 228).

Erwinia amylovora, fireblight. Hemphill and Goodman reported experiments at the University of Missouri to determine the effects of plant growth-regulating substances on control of E. amylovora by streptomycin and Terramycin. The results indicated that the improved control was not a direct effect of growth-regulating substances on the pathogen but of some host reaction (Science 122 (3159): 122). In Missouri, R. N. Goodman discussed late season twig-infection as a factor limiting effectiveness of antibiotics for fireblight control (PDR 39: 922).

Physalospora obtusa, black rot and leaf spot. At North Carolina State College, J. F. Fulkerson studied the relation of light to the production of pycnidia by P. obtusa. (Phytopath. 45: 22) Apple black rot in Georgia and its control was reported by J. Taylor. The results of inoculation experiments demonstrated the importance of maturity; April infections will not cause severe fruit rot until 4 to 8 weeks before harvest, whereas inoculated ripe fruit will be completely decayed in 3 to 5 days (Phytopath. 45: 392).

Roderick Sprague reported the compatibility of sodium pentaborate, which is applied in spray form to correct boron deficiency, with sprays used for apple powdery mildew (Podosphaera leucotricha) control. (PDR 39: 820).

Dapple apple is a descriptive name for a fruit symptom observed in one New Hampshire orchard, cause unknown but possibly virus (W. W. Smith and others, PDR 40: 765).

Scarskin, a disorder of the fruit of the Red Delicious variety of apple, has been noted in commercial orchards in northern Missouri. A corky condition in the periderm tissue so defaces the fruit as to make the crop unmarketable. The trouble appears to be restricted to the Delicious variety and was limited to a few trees. (D. F. Millikan and W. R. Martin, Jr. PDR 40: 229).

PERSEA AMERICANA. AVOCADO: In California, Zentmyer and Bingham reported the influence of nitrite on the development of Phytophthora root rot of avocado (Phytopath. 46: 121).

A necrotic injury to avocado leaves in California, hitherto attributed to insect damage, is apparently the result of an as yet undetermined physiological disorder. The damage is less serious than that caused by insects, but is more widely distributed throughout southern California and usually more abundant. The disease may destroy 25 to 50 percent of the surface of leaves in the interior of the tree (W. Ebeling, Calif. Agri. 9(8): 9, 1955).

PRUNUS spp. A Cytospora sp. causing canker on Italian prunes was observed for the first time in Idaho in 1951. Similar cankers were also found on sweet cherry. In recent orchard surveys the fungus was observed on cherries, peaches, apricots, apples, and willows, indicating that it is serious and wide-spread in most of the southwestern part of the State (A. W. Helton and J. A. Moisey, PDR 39: 931).

Xanthomonas pruni, bacterial spot. R. N. Goodman and P. Shepard obtained promising results from tests with streptomycin preparations against bacterial spot (PDR 40: 93).

PRUNUS spp. CHERRY: Of materials tested in New York a combination of Acti-dione and sulfur gave outstanding control of both powdery mildew (Podosphaera oxyacanthae) and leaf spot (Coccomyces hiemalis) on cherry nursery stock. Copper fungicides gave good control of leaf spot alone. Other fungicides tested were not so satisfactory (R. M. Gilmer, PDR 39: 762). Gilmer also reported data demonstrating that necrotic ring spot virus, or a virus capable of causing symptoms in cucumber plants indistinguishable from those caused by necrotic ring spot virus, occurs in Europe and may be imported into the United States in mahaleb seeds (PDR 39: 727).

PRUNUS PERSICA. PEACH: Daniel H. Cohoon and R. H. Daines reported nodal cankers on peach trees produced by Fusicoccum amygdali, appearing throughout the year with the greatest number occurring in the spring and fall. Inoculation experiments showed that twig infections occur at bud scales, stipules, fruit and leaf scars, and at the blossoms. Temperature studies indicated that resistance to leaf scar infections developed more rapidly at 80° F than at lower temperatures (PDR 40: 304).

Nemagon at certain concentrations gave satisfactory control of peach root knot (Meloidogyne spp.) in South Carolina, according to H. H. Foster and L. W. Baxter (PDR 40: 400).

Xanthomonas pruni, bacterial spot, has not yet been adequately controlled by the use of chemical sprays. According to R. H. Daines captan has become the standard New Jersey remedy in combating this disease but it also leaves much to be desired. Antibiotics as foliage sprays have shown little promise of effective control of bacterial spot (PDR 40: 335).

N. S. Wilson and others reported an apparently undescribed species of Eriophyes to be a vector of peach mosaic virus. Near Riverside, California, it was found on infected peach trees beneath the closely adhering bud scales, and on plums (five species) also on rudimentary leaves of new growth. The virus was transmitted by the mite from peach and plum to peach seedlings in the greenhouse. The same species of Eriophyes was later collected from mosaic-infected orchards in western Colorado, Arizona, and New Mexico (PDR 39: 889).

Boron deficiency. A. C. McClung and C. N. Clayton described a disorder of peach trees in the Sandhills area of North Carolina. Evidence indicated that boron deficiency was responsible but definite proof was difficult to obtain (PDR 40: 542).

PRUNUS VIRGINIANA. CHOKECHERRY: Chokeberry, which grows abundantly in canyons and on the foothills of the mountainous regions of the Western States is an important source of X-disease virus, transmitted by the leafhopper Colladonus geminatus. The trees can be eradicated by the use of foliage sprays containing low volatile esters of 2,4-D, or mixtures of 2,4-D and 2,4,5-T at a concentration of 2,000 p.p.m. by weight in water. Treatments each year at the full blossom and leaf stage in early June usually suffice to kill 90 percent of the trees within two years (W. O. Lee and F. L. Timmons. Down to Earth 11 (4), 1956).

RUBUS SPP. BLACKBERRY: Agrobacterium rubi, cane gall. At the Oregon State College E. K. Vaughan reported three unusual manifestations of cane gall on cultivated blackberry (Phytopath. 45: 56).

RUBUS SPP. RASPBERRY: E. K. Vaughan and H. W. Wiedman reported that at the Oregon Agricultural Experiment Station, a ring spot virus was transmitted by grafting from red raspberry to a clone of Fragaria vesca. To the authors' knowledge this is the first report of the transmission of a virus from raspberry to strawberry (PDR 39: 542).

VACCINIUM SPP. BLUEBERRY: K. Maramorosch reported the transmission of the blueberry-stunt virus by Scaphytopius magdalensis in New York. Similar observations were made in New Jersey (Journ. Econ. Ent. 48: 1-8).

VITIS SPP. GRAPE: F. N. Harmon and J. H. Weinberger discussed foliage burn and other symptoms of the white-Emperor virus disease of grapes in California (PDR 40: 300).

DISEASES OF NUT CROPS

CARYA ILLINOENSIS. PECAN: Cladosporium effusum, scab, has long been recognized as one of the factors limiting pecan production. It has been reported from Mississippi on Stuart, up to now considered the most resistant variety, according to John R. Cole and A. C. Gossard (PDR 40: 156).

JUGLANS REGIA. PERSIAN WALNUT (ENGLISH WALNUT): Hendersonula toruloidea, branch wilt, according to J. H. Foott and others, has become particularly destructive in Tulare County, California. It may be reduced by annual removal of diseased branches, by the use of nitrogenous fertilizer, and by irrigation during the growing season (Calif. Agri. 9 (10): 11. Sunburn predisposes walnut trees to branch wilt in California, according to N. F. Sommer (Phytopath. 45: 607).

Xanthomonas juglandis, bacterial blight. Agrimycin 100 was as effective as copper compounds for the control of walnut blight in Oregon, and was not injurious, according to P. W. Miller (PDR 40: 626).

DISEASES OF ORNAMENTAL AND MISCELLANEOUS PLANTS

CAMELLIA SPP. CAMELLIA: Sclerotinia camelliae, flower blight. According to C. A. Hanson all species and varieties of camellias have been found to be equally susceptible to flower blight. During the spring of 1955 applications of captan as soil drenches in nurseries in southern California reduced incidence by as much as 90 percent. Fortnightly sprays during the flowering period, or more frequently after rain, gave best control (Camellian 6 (3): 5, 29).

CANNA GENERALIS. CANNA: Canna-mosaic virus has been transmitted to canna, corn, and bean by means of juice and by means of the aphids, Aphis gossypii, Aphis maidis, and Myzus persicae in California according to B. S. Castillo and others (PDR 40: 169).

CASTILLEJA AUSTROMONTANA. INDIAN PAINTBRUSH: Cronartium filamentosum, ponderosa pine rust. F. G. Hawksworth pointed out that the possibility of heteroecism of this important rust has not been confirmed in existing literature. Preliminary inoculation tests showed that this one species of Indian paintbrush is susceptible to the rust (PDR 40: 581).

CHRYSANTHEMUM spp. CHRYSANTHEMUM: Relations between temperature and the geographical distribution of chrysanthemum rust (Puccinia chrysanthemi) were studied at Ithaca, New York by Campbell and Dimock. Results explained the limitation of severe damage in North America to generally cool areas. (Phytopath. 45: 644).

Philip Brierley reported Blazing Gold as a test variety for the chrysanthemum flower-distortion virus. Introduction of the virus from Europe is believed to have been quite recent, but since it occurs in American rather than imported varieties a vector must be present in the United States (PDR 39: 899). Brierley also reported symptoms induced in chrysanthemums inoculated with the viruses of mosaics, aspermy, and flower distortion (Phytopath. 45: 2).

EUPHORBIA PULCHERRIMA. POINSETTIA: Thielaviopsis basicola, root rot. In Maryland, John R. Keller and James B. Shanks stated that there are two phases of root rot in greenhouse-grown poinsettias. The first appears when cuttings are rooted and is caused chiefly by species of Rhizoctonia and Pythium. The second appears as a late season rot just before the plants mature. In older plants, T. basicola is the primary pathogen, but root injury is increased by the simultaneous presence of Rhizoctonia and Pythium (Phytopath. 45: 552).

GLADIOLUS SPP. GLADIOLUS: Meloidogyne spp., nematodes. According to J.C. Wells and N. N. Winstead nematode diseases are considered to be one of the major disease problems in southeastern North Carolina where gladiolus is an important floral crop. The reaction of 20 of the most widely grown varieties to five species of Meloidogyne was determined under greenhouse conditions (PDR 40: 177).

PRUNUS SERRULATA. FLOWERING CHERRY: Little cherry (virus). In Oregon and Washington, buds from certain symptomless Kwanzan and Shiro-fugen flowering cherry source trees used as virus test plants produced fruit symptoms on Lambert and Bing cherry trees resembling those of little cherry, according to E. L. Reeves and others (PDR 39:725).

RHODODENDRON spp. AZALEA: Ovulinia azaleae, petal blight, appeared in California in 1940. It has spread and is now causing concern, according to Raabe and Sciaroni. Cool rainy weather favors the disease. Control is difficult and rendered more so by the rapid succession of bloom. Spraying three times a week during the cooler part of the day with Parzate or Dithane Z-78 is recommended. Infected flowers should be destroyed. Ground sprays of Fermate before flowering destroy the ascospores; so does mulching; another precaution is not to splash when watering. Entry of the fungus into a planting can be prevented by ensuring that new plants are flowerless and bare-rooted (Calif. Agri. 9 (10): 7, 14).

DISEASES OF SHRUBS AND TREES

A. W. Engelhard and J. C. Carter summarized records of Verticillium albo-atrum on woody hosts in Illinois 1945-1955 (PDR 40: 459).

BETULA LUTEA. YELLOW BIRCH: R. P. True and others reported Poria laevigata and P. obliqua as causing serious decay of yellow birch in the Monongahela National Forest of West Virginia. P. laevigata produces bark-covered cankers associated with extensive white rot which renders the timber unmerchantable. P. obliqua, also causing white rot, produces sterile, perennial, clinker-like conks on branch stubs, seams, or wounds on the trunks of affected trees (Forestry Jour. 53: 412).

LIQUIDAMBAR STYRACIFLUA. SWEETGUM: G. Y. Young reported observations on the progress of sweetgum blight (cause unknown) in Maryland plots in 1955 (PDR 40: 249).

LIRIODENDRON TULIPIFERA. YELLOW-POPLAR: Verticillium albo-atrum, wilt. Alma M. Waterman reported that a few years ago in Milford, Connecticut, a yellow-poplar lawn tree was reported by the owner to be gradually wilting and dying. An examination in September showed about ten affected branches scattered through a 20-foot tree. From greenish streaks in the wood of these branches, Verticillium was isolated (PDR 40: 349).

PICEA ENGELMANNII. ENGELMANN SPRUCE: R. W. Davidson reported that in his work at the Rocky Mountain Forest and Range Experiment Station, in Colorado, four species of the Ophiostomataceae were found to be associated with the bark beetle Dendroctonus engelmanni in bark of dying Engelmann spruce. Leptographium engelmanni, which causes a light gray stain in the sapwood, was found in every tree examined and known to have been killed by the insect. Ophiostoma truncicola was found in the main galleries of the beetles. Endoconidiophora coerulescens was occasionally present in the galleries and was also found on the sapwood of logs cut from beetle-infested trees. O. bicolor was isolated once from an adult D. engelmanni beetle, but was also obtained from other sources in Canada. L. engelmanni, O. truncicola, and O. bicolor are described as new species. (Mycologia 47: 58).

PINUS SPP. PINE: A. A. Foster reported diseases occurring in forest nurseries in Georgia. The rapid expansion of the pulp and paper industry in the Southeast has placed new emphasis on the production of pine seedlings. The Georgia Forestry Commission produces and distributes 115 million seedlings annually. Control of diseases is an important factor in keeping the cost of production near the $3.00 per thousand selling price (PDR 40: 69).

Arceuthobium spp., dwarf mistletoe. Frank G. Hawksworth reported that lodgepole pine (Pinus contorta) and ponderosa pine (P. ponderosa var. scopulorum) are each attacked by a distinct species of dwarf mistletoe in the central Rocky Mountains. A. americanum occurs on lodgepole pine; A. vaginatum f. cryptopodum on ponderosa pine. This Colorado report recorded observations on natural crossovers of dwarf mistletoe from ponderosa pine to lodgepole pine and vice versa in stands where the two pines intermixed. This is apparently the first report of A. vaginatum f cryptopodum on lodgepole pine (PDR 40: 252).

PINUS MONTICOLA. WESTERN WHITE PINE: Lesions associated with pole blight (cause unknown) of western white pine in northern Idaho were reported by C.D. Leaphart and L. S. Gill (For. Sci. 1: 232).

PINUS STROBUS. WHITE PINE: Alma M. Waterman reported a stain technique devised at the Forest Insect and Disease Laboratory, New Haven, Connecticut, for detecting blister rust (Cronartium ribicola) in cankers on white pine in the eastern United States (For. Sci. 1: 219).

POPULUS TREMULOIDES. ASPEN: Hypoxylon pruinatum, canker. In June 1955, during decay studies in aspen on the Routt National Forest, north of Hayden, Colorado, Hypoxylon cankers were observed for the first time by Ross W. Davidson and Thomas E. Hinds. Hypoxylon cankers were also observed in southwestern Colorado. (PDR 40: 157).

PROSOPIS JULIFLORA. MESQUITE: Ganoderma zonatum has been found associated with dead and dying mesquite in Texas. In greenhouse experiments inoculation of mesquite seedlings growing in unsterilized soil did not reproduce the disease in any instance, but when sterilized soil was used-100 percent killing resulted. (D. C. Norton and Richard Behrens, PDR 40: 253).

QUERCUS SPP. OAK. Endoconidiophora fagacearum, oak wilt. In West Virginia, R. P. True and W. H. Gillespie reported on the effectiveness of deep dry girdling of oaks for the suppression of oak-wilt mat formation and the prevention of the overland spread of oak wilt (PDR 40: 245). Isolations from borings made in standing oak trees killed by wilt in Missouri indicated that by the time mycelial mats are produced the fungus may have invaded any part of the sapwood (T. W. Jones and T. W. Bretz PDR 39: 872). A. W. Engelhard discussed results obtained from inoculation of oak trees with the oak wilt fungus at different times of the year and with different types of inoculum (PDR 40: 1010).

During investigations at the Iowa Agricultural Experiment Station on the dissemination of the oak wilt fungus, 442 fungal isolates (41 genera) were obtained by swabbing the beaks and throats of 306 birds from affected areas. The oak wilt fungus was not among them (Iowa Coll. Jour. Sci. 29: 659). Experimental transmission of the oak wilt fungus by caged squirrels was reported by Himelick and Curl (Phytopath. 45: 581).

According to W. J. Stambaugh et al. the bark and wood-boring beetles, Agrilus bilineatus, Xyleborus spp., Xyleterinus politus, and Pseudopityophthorus spp., were found to carry viable spores from diseased tree parts. These insects have not been observed to feed on mycelial mats and presumably obtain inoculum from the sapwood. This finding may explain cases recently observed in Pennsylvania of the spread of the disease 50 to 150 feet beyond the nearest known infected tree (PDR 39: 867). E. A. Curl reported that the results of greenhouse tests showed that spring tails (Collembola) can carry spores of E. fagacearum on their bodies from a source of conidia or a source of conidia plus ascospores to wounds on healthy oak seedlings, resulting in infection and death of the trees. The results obtained here, along with facts relating to the life cycle of the Collembola, indicate that these insects may be potential vectors of the oak wilt fungus (PDR 40: 455). Experimental evidence that the small oak barkbeetle (Pseudopityophthorous minutissimus) can carry the oak wilt fungus (Endoconidiophora fagacearum) was reported by W. D. Buchanan in Missouri (PDR 40: 654).

Since August 1955, 300 new infection spots of wilt have been located in West Virginia, four of which constitute the first known records in Marion, Harrison, Fayette, and Calhoun Counties. A partial survey of the State in 1954 revealed a total of only 145 individual trees with oak wilt. The underground spread through natural root grafts was more frequent than previously observed and caused greater loss at individual sites in some northeastern counties than in other parts of the State (R. P. True and W. H. Gillespie PDR 39: 783).

Polyporus hispidus. In Mississippi, from the Delta Experimental Forest at Stoneville, E. R. Toole reported on the occurrence of trunk cankers and localized decay caused by P. hispidus on Q. phellos, Q. nigra, Q. nuttallii, and Q. falcata var. pagodaefolia (Phytopath. 45: 177).

ULMUS spp. ELM: Francis W. Holmes recorded Dutch elm disease (Graphium ulmi) distribution in North America as of 1955 (PDR 40: 351).

DISEASES OF SPECIAL CROPS

J. O. Andes reported estimated loss from plant diseases of major importance in Tennessee in 1955 (PDR 40: 162).

AGARICUS CAMPESTRIS. MUSHROOM: Dactylium dendroides, mildew. B. B. Stoller and others reported results with various chemicals tested for the control of Dactylium mildew of cultivated mushrooms in California. Experiments with Terraclor have shown that this fungicide can eradicate mildew even often it is well established on the beds and, also, that it has a relatively long residual effect (PDR 40: 193).

At the Plant Industry Station, Beltsville, Maryland, T. T. Ayers and E. B. Lambert reported that the use of chlorinated water for wetting mushroom beds throughout the cropping season caused no yield reduction and effectively controlled bacterial blotch (Pseudomonas tolaasi), Verticillium sp., and Mycogone perniciosa. It also prevented the development of bacterial soft rot of the pinheads (PDR 39: 829).

ALOË VARIEGATA. ALOE: Pythium root rot (P. ultimum) of Aloë variegata in California was controlled by the hot-water treatment, according to K. F. Baker and R. D. Durbin (Cactus & Succ. Jour. Los Angeles, 28(2): 45-46 Mar.-Apr. 1956).

ARACHIS HYPOGAEA. PEANUT: D. C. Norton and others reported a study of fungi associated with blemished Spanish peanuts in Texas. Aspergillus flavus, Alternaria spp., and Fusarium spp. were the most common fungi isolated (PDR 40: 374).

Weed control studies in peanut fields in 1954, according to Chappell and Miller, indicated that peanut plants in herbicide-treated areas were often larger and grew more vigorously than those in untreated areas. Studies in the laboratory in the summer of 1954 showed that certain herbicides were effective against several parasitic fungi and the sting nematode (Belonolaimus gracilis). Disease intensity in the field associated with herbicide-treated peanuts in 1955 was measured and recorded. Whether the herbicides actually act as fungicides and nematocides under field conditions was not definitely established, but evidence was presented that their usage may influence disease development in peanuts (PDR 40: 52).

BETA VULGARIS. SUGAR BEET: Fink and Buchholtz reported the correlation between sugar beet crop losses and greenhouse determinations of soil infestation by Aphanomyces cochlioides. The results showed that the degree of soil infestation in a particular field can be determined prior to planting and this may prove to be an insurance against subsequent crop failure (Proc. Amer. Soc. Sug. Beet Tech. 8: 252).

Cylindrocladium scoparium, a weak pathogen on various plants, was identified at Beltsville, Maryland as the pathogen responsible for the scurf of sugar beets, first observed at Arlington Farm, Virginia, in 1935 and again at Blissfield, Michigan, in 1947, in which the root crown became brown and cracked and the petioles withered. Culture studies and inoculation experiments showed the fungus to be a weak pathogen on sugar beet. (P. L. Lentz, PDR 39: 654).

At the Nebraska Agricultural Experiment Station J. Dunleavy reported on the control of damping-off (Rhizoctonia sp.) of sugar beet by Bacillus subtilis. Inhibition of the fungus by the bacterium was promoted by low and retarded by high temperatures, and the amount of manure in the soil determined the extent of the process. The addition of a high-nitrogen nutrient solution to a non-sterile soil improved the control of damping-off (Phytopath. 45:252).

Virus yellows. C. W. Bennett and others reported the effect of virus yellows on yield and sucrose content of sugar beet in tests at Riverside, California (Proc. Amer. Soc. Sug. Beet Tech. 8: 236).

CARTHAMUS TINCTORIUS. SAFFLOWER: Puccinia carthami, rust. In inoculation experiments conducted at Beltsville, Maryland, the rust-resistant safflower variety W. O. 14 and other resistant selections were susceptible to race 2 of the rust, a new race first observed in 1954 in one field in California. In 1955 many of the lines resistant to the common race were affected by the rust, indicating that the new race may cause serious damage (C. A. Thomas, PDR 39: 652).

GOSSYPIUM spp. COTTON: The Committee on Cotton Disease Losses reported reduction in yield of cotton caused by diseases in 1955 (PDR 40: 153).

Stem intumescences resulting from flooding of cotton plants apparently are due to abnormal stem metabolism induced by the surrounding water, according to Wayne J. McIlrath (PDR 40: 65).

D. N. Fulton and others reported that temperature during seedling growth has been shown to have a significant influence on the species of fungi isolated from diseased cotton seedlings (PDR 40: 556). C. D. Ranney described and illustrated the construction of a constant temperature tank battery for cotton seedling disease investigations (PDR 40: 559).

Viability of cotton seed and infection by anthracnose (Colletotrichum gossypii) in South Carolina in the two contrasting years 1954 and 1955 was related to amount and frequency of rainfall at boll opening, according to investigations reported by C. H. Arndt (PDR 40: 1001).

Eugene E. Staffeldt and Paul A. Fryxell described a method of estimating reaction of cotton varieties and selections to Verticillium wilt (PDR 39: 690).

Xanthomonas malvacearum, bacterial blight, occurs throughout the cotton-growing areas of the world. In the United States, the estimated reduction in 1955 cotton yield caused by this disease was 222,611 bales, or 1.08 percent loss. Losses from the disease are greatest in the Southwest. Bacterial blight resistant varieties and strains of cotton are listed, with descriptions and seed sources (D. M. Simpson PDR 40: 549).

HIBISCUS CANNABINUS. KENAF: Certain lines of kenaf exposed to infection by the anthracnose fungus Colletotrichum hibisci reacted differently at different temperatures, in experiments reported by Summers and Pate (PDR 39: 650). They also reported the reaction of kenaf breeding materials to different races of the anthracnose fungus (PDR 39: 776).

NICOTIANA spp. TOBACCO: During a 1955 survey in Maryland 25 genera of known or suspected plant-parasitic nematodes were found on corn, tobacco, and soybean, according to W. R. Jenkins and others (PDR 40: 37).

Peronospora tabacina, blue mold. According to reports to the Plant Disease Warning Service, blue mold occurred in Georgia plant beds in Cook County, and in Florida, South Carolina, North Carolina, Virginia, Pennsylvania, Connecticut, and Massachusetts. In North Carolina the disease was scattered throughout the Border and Eastern belts with only one report in the season from the Burley area. Blue mold in the field in this State was reported from 9 counties. Shortage of plants occurred in some places owing to one or more reasons, including the neglect of spraying or dusting, carelessness in thoroughness and regularity of application of fungicides, and the severe freeze in the southern area at the end of March which came after a period of unusually warm weather.

In cooperative studies by the Agricultural Research Service and the University of North Carolina sessile sporangia produced on oospores of the blue mold fungus used for inoculum were identified as a species of Phlyctochytrium. The fact that this and other chytrids may attack the oospores and prevent their germination could partly explain the occurrence of only scattered foci of infection in the plant bed (L. H. Person and others. PDR 39: 887).

Phytophthora parasitica var. nicotianae, black shank. W. Lautz summarized a 5-year study of soil treatments with nine chemicals for control of black shank. Some chemicals gave control in some years but not in others (PDR 40: 855). J. N. Sasser and others reported the relationship of root-knot nematodes (Meloidogyne spp.) to black shank (Phytophthora parasitica var. nicotianae) attack as determined in greenhouse tests at the North Carolina Experiment Station. They concluded that control of the nematode either by soil fumigation or crop rotation should be practiced in fields invaded by black shank pending the development of root knot-resistant varieties. (Phytopath. 45: 459).

Pseudomonas tabaci, wildfire. Luther Shaw and George W. Thorne Jr. reported wildfire control studies in burley tobacco plant beds in North Carolina in 1955. Spray treatments with Terramycin and standard copper drench treatments were substantially less effective in wildfire control than the spray and dust formulations with streptomycin tested (PDR 40: 325). H. E. Heggestad and others reported that streptomycin gave more effective control of tobacco wildfire when applied as a spray than as a dust. Tests were conducted at Greenville, Tennessee and Beltsville, Maryland (PDR 40: 48). The value of streptomycin sulfate in the preventative and eradicative control of wildfire of tobacco in Tennessee was summed up by G. N. Rhodes and others (PDR 40: 202).

Pseudomonas solanacearum, bacterial (Granville) wilt. In South Carolina G. B. Lucas and others investigated the relationship of root-knot nematodes to Granville wilt resistance in tobacco. The results of the experiments indicated that root knot should be combated in fields heavily contaminated by P. solanacearum in order to gain maximum benefit from the use of wilt-resistant varieties (Phytopath. 45: 537). The stunt nematode, Tylenchorhynchus claytoni, did not increase severity of bacterial wilt on tobacco in experiments reported by G. B. Lucas and L. R. Krusberg (PDR 40: 150).

Q. L. Holdeman and W. H. Burkholder reported the identity of barn rots (Pythium aphanidermatum and Erwinia aroideae) of flue-cured tobacco in South Carolina. These rots tend to accompany wet weather (Phytopath. 46: 69).

Viruses. Greenhouse studies at the University of California on the physical properties, host range, and symptomatology of two strains of tobacco ring spot virus and one of the lettuce calico virus suggested that the latter is a distinct strain of the tobacco ring spot virus group. Both tobacco ring spot strains were able to protect tobacco against the lettuce virus, but the reverse could not be demonstrated (PDR 39: 803).

In North Dakota, W. G. Hoyman reported that strains of virus X in expressed sap of Nicotiana glutinosa frozen in 1951, and of X and Y in N. glutinosa and X in potato sap frozen in 1954, were still infective when tested on indicator plants in 1955 (Amer. Potato Jour. 32: 390).

Weather fleck. During 1955 weather fleck, a physiological leaf spot disease, occurred with great severity in experimental tobacco plantings at Beltsville, Maryland. Observations suggested that weather fleck results from cellular breakdown conditioned by environmental factors. Variable amounts of weather fleck developed about mid-July. Maryland Medium proved to be the most resistant variety (L. G. Burk and H. E. Heggestad, PDR 40: 424).

SACCHARUM OFFICINARUM. SUGARCANE: The release of two new sugarcane varieties for commercial planting during the autumn of 1955 was jointly announced by the U. S. Department of Agriculture, the Louisiana Experiment Station, and the American Sugarcane League. Both varieties are described as resistant to sugarcane mosaic virus and moderately so to red rot (Glomerella tucumanensis). They are further reported to have responded favorably to heat treatment for the elimination of stunting virus, to which, however, they appear to be more susceptible than the present commercial varieties. (Sugar, N. Y. 50(8): 43, 1955).

SESAMUM INDICUM. SESAME: A bacterial leaf spot complex of sesame in Texas was reported by D. D. Poole and Carl D. Heather as involving a Pseudomonas sp. and a hitherto unreported genus on sesame, Xanthomonas sp. (PDR 40: 236).

DISEASES OF VEGETABLE CROPS

P. J. Leyendecker and R. M. Nakayama's summary of incidence of plant diseases in New Mexico in 1955 included many vegetable diseases (PDR 40: 159).

R. B. Marlatt discussed the relative tolerances of vegetables to streptomycin sulfate as observed in Arizona. (PDR 40: 200).

Host range studies with Meloidogyne hapla were conducted in the field and greenhouse at Newark, Delaware, and reported by Timothy A. Gaskin and H. W. Crittenden (PDR 40:265).

ASPARAGUS OFFICINALIS. ASPARAGUS. A hitherto unreported crown and root rot (Penicillium martensii) of overwintering asparagus plants has become prevalent during the last ten years in the Yakima Valley, Washington. Results of inoculation experiments yielded conclusive evidence that the fungus is a wound parasite, and freezing injury was shown to be a predisposing factor in its occurrence. Control should be based on the hilling of plants in the autumn to prevent damage from this source, roguing of diseased material at transplanting time, and care in the handling of transplants to avoid unnecessary injury. Fungicidal treatment at this period proved ineffective. (Phytopath. 45: 527).

Puccinia asparagi, rust. In Illinois, A. E. Thompson and P. R. Hepler reported that most species of Asparagus inoculated with rust have shown some degree of susceptibility (PDR 40: 133).

BRASSICA OLERACEA var. BOTRYTIS. BROCCOLI, CAULIFLOWER: Peronospora parasitica, downy mildew. J. J. Natti and others discussed reasons for the increased prevalence of downy mildew on broccoli in New York, and reported results of control test. Agrimycin and Spergon SL were the most promising materials for the control of downy mildew (PDR 40: 118).

In West Virginia, Gallegly and Bishop reported pentachloronitrobenzene for control of clubroot (Plasmodiophora brassicae) of broccoli and cauliflower. The treated plants developed excellent fibrous roots with only a few small clubs at the extremities and produced normal yields. The cost of treating one acre with PCNB at the lowest rate in the transplant water was $15 (PDR 39: 914).

BRASSICA OLERACEA var. CAPITATA: CABBAGE: Fusarium oxysporum f. conglutinans, yellows, was first reported in Louisiana in St. Martin Parish in 1948. In October 1953, several diseased cabbage plants were sent to Dr. W. G. Martin at Baton Rouge from Plaquemines Parish (south of New Orleans). In October 1955, diseased cabbage plants were received from St. Martin Parish by Dr. A. G. Plakidas, who identified the disease as cabbage yellows. So far, in Louisiana the disease is known to occur in only the two parishes. (E. C. Tims and R. T. Brown, PDR 40: 905).

In continued studies at the Truck Crops Branch Station, Crystal Springs, Mississippi, on varietal resistance to black rot (Xanthomonas campestris) in cabbage, D. C. Bain reported the disappearance of black rot symptoms in cabbage seedlings (Phytopath. 45: 35).

BRASSICA OLERACEA GEMMIFERA. BRUSSELS SPROUTS: Plasmodiophora brassicae, club root, on Brussels sprouts, which is serious in San Mateo County, California, spread in one planting from a few diseased plants to the whole of a 20-acre planting in two years. Chemicals applied in setting water controlled the soil borne disease. (Calif. Agr. 9 (10): 8).

CAPSICUM FRUTESCENS, PEPPER: In Louisiana, W. J. Martin and others reported fumigation of bell pepper seed beds for controlling damping-off caused by Rhizoctonia solani (PDR 39: 678).

Xanthomonas vesicatoria, bacterial spot. R. S. Cox reported compatibility between streptomycin and copper in the control of bacterial spot of pepper in Florida. (PDR 39:616).

Later he reported consistent control with streptomycin and/or neutral copper formulations. An additive effect was noted when these materials were used together. Other materials gave no control of bacterial spot but appeared to be compatible with streptomycin (R.S. Cox. PDR 40: 205).

CUCURBITS. CUCUMBER, MELON, SQUASH: Cladosporium cucumerinum, scab. Saul Rich reported that the addition of glycerin improved the chemotherapeutic activity of zineb against cucumber scab (PDR 40: 620).

Foliage inoculation tests in the greenhouse indicated that varieties of Cucumis sativus, Cucumis melo, Cucurbita pepo, and Cucurbita maxima were susceptible to eight isolates of tomato anthracnose-inciting fungi (Colletotrichum spp., Glomerella cingulata), according to Maria E. Pantidou and W. T. Schroeder in New York (PDR 40: 432).

Colletotrichum lagenarium, anthracnose. D. F. Crossan and P. J. Lloyd reported successful infection of cucumber plants in the field by spraying the vines with a spore and mycelial suspension of C. lagenarium. Despite the severe conditions of the test, both maneb and zineb gave excellent control of leaf infection and significent increases in yield of marketable cucumbers over untreated rows. No phytotoxic effect of either material was observed (PDR 40: 63).

Studies reported by M. J. Goode indicated that there are two or more physiologic races of Colletotrichum lagenarium on watermelon in North Carolina (PDR 40: 741).

Erwinia tracheiphila, bacterial wilt. J. D. Wilson and others in South Carolina reported that two foreign cucumber lines showed resistance to bacterial wilt and powdery mildew (Erysiphe cichoracearum) (PDR 40: 437). Results of greenhouse and field tests of various antibiotics for control of cucumber bacterial wilt were reported by L. E. Williams and J. L. Lockwood (PDR 40: 479).

Erysiphe cichoracearum, powdery mildew. T. E. Randall and J. D. Menzies reported the occurrence of the perithecial stage of this species on Cucumis sp. in Washington (PDR 40: 255).

J. H. Owen reported a destructive wilt of cucumbers, attributed to a new form of Fusarium oxysporum in Florida. It caused damping-off of seedlings and a typical vascular wilt of older plants (Phytopath. 45: 435).

Meloidogyne spp., root knot nematodes. According to N. N. Winstead and J. N. Sasser, cucumber varieties were susceptible to four of the five root-knot nematodes, while Cucumis anguria was susceptible only to M. incognita acrita (PDR 40: 272).

Mycosphaerella melonis, gummy stem blight. Incidence of gummy stem blight and other diseases on cucumbers in South Carolina in the 1955 fall season, and control of cucumber diseases achieved with various fungicides from 1946-1955 are reported by W. M. Epps (PDR 40: 439, 441).

Pseudomonas lachrymans, angular leaf spot. P. A. Ark and M. W. Gardner reported that within the last few years angular leaf spot of cucumber was noted in two coastal counties in California. Several growers have experienced considerable loss, affecting mostly the variety National Canner which is grown both for market and for the canneries. The disease occurred in epidemic form in fields in Alameda County planted with California-grown seed and irrigated by overhead sprinkler or by row irrigation where the rows were occasionally flooded (PDR 40: 61). Pyrophyllites, hydrated lime, sulfur, calcium and magnesium carbonates served as excellent dust carriers of streptomycin, releasing it readily when in contact with water. Good control of cucumber angular leaf spot resulted in tests with pyrophyllite- and hydrated lime-streptomycin formulations dusted on both sides of the leaf followed by mechanical inoculation (R. A. Ark and E. M. Wilson. PDR 40: 332). S. P. Doolittle and F. S. Beecher reported the effect of streptomycin formulations on occurrence of angular leaf spot of cucumber (PDR 39: 731).

Pseudoperonospora cubensis, downy mildew. According to reports to the Plant Disease Warning Service, downy mildew of cucurbits was found in Atlantic Coast Seaboard States as far north as New York, and occurred also in Indiana and Kentucky. The westward spread into Kentucky and Indiana was noteworthy. In Kentucky it was the first occurrence on cantaloupe in many years. The epidemic in eastern Indiana was associated with 8 to 10 inches of rain during midsummer. No control measures for downy mildew of cucurbits were discussed in the warning letters this year except that rain in some places prevented adherence to a regular fungicide application schedule. Where extremely hot, dry conditions obtained, no dusting programs were recommended.

Verticillium albo-atrum for the past several years has caused repeated losses to melon growers in the San Joaquin valley of California. The Cassaba and Persian varieties seemed to be the most susceptible varieties of Cucumis melo. Not infrequently almost the entire production of Cassaba has been worthless. The most serious outbreaks of the wilt in melons have been on land cropped repeatedly to melons or previously planted to tomatoes (S. Wilhelm and E. E. Stevenson, PDR 39: 881).

R. S. Cox suggested cold pox as a name for a serious new disease of cucumbers observed in southern Florida. Blister-like, light olivaceous areas appear on the fruit, coalescing and becoming dried and fissured with age. The cause is unknown, but field observations indicated that the trouble is associated with a sequence of variable weather conditions, always including a period of low temperature. The minimum temperature necessary is above freezing. With favorable weather the symptoms disappear, but may recur several times during the growing season (PDR 39: 478).

Viruses. J. B. Sinclair and J. C. Walker reported that tobacco ring spot virus has been found to be widely prevalent in cucumbers in central Wisconsin, frequently occurring together in the same plant with the cucumber mosaic virus, which raises questions as to the effects of interaction between the two viruses (PDR 40: 19).

IPOMOEA BATATAS. SWEETPOTATO: Monilochaetes infuscans, scurf. Investigations in New Jersey showed that scurf of sweetpotato may increase and spread in storage under high relative humidity, 85 to 90 percent, but there was no evidence of development or spread in houses where humidity was kept at 65 to 75 percent. (R. H. Daines, PDR 39: 617).

Internal cork (virus). Results of experiments reported by W. J. Martin at the Louisiana State University confirmed previous findings that the incidence and severity of the internal cork virus lesions in sweetpotato increase rapidly during storage at 70° to 80° F, but to a negligible extent at 50° to 60°. In roots stored at 50° to 60° for 150 to 200 days and then kept at 80° for 14 days there was little or no increase of cork lesions. There should be sufficient time for marketing the sweetpotatoes after removal from cold storage before a severe increase in cork lesions occurs (PDR 39: 619). Insect control reduced incidence of sweetpotato internal cork in experiments in Louisiana reported by E. J. Kantack and W. J. Martin (PDR 40: 410).

LACTUCA SATIVA. LETTUCE: Marssonina panattoniana, anthracnose. According to H. B. Couch and R. G. Grogan anthracnose occurs on commercial and wild lettuce in California during the cool wet months of February and March, but becomes inactive during the warm dry summer months. They studied the disease under California conditions, with particular emphasis on source of primary inoculum and other etiological factors that might influence occurrence, development and spread of the disease. Thirty-eight other species, representing some 35 genera in the Compositae, were tested as possible hosts. Of these only Lactuca spp. and Bellis perennis (English daisy) were found to be susceptible (Phytopath. 45: 375).

Big-vein (virus). Treatment of healthy lettuce seedlings with various chemotherapeutants prior to setting out in a field infested with soil-borne lettuce big-vein virus may be a practical method of reducing losses from big vein, according to Saul Rich (PDR 40: 414).

Mosaic (virus). H. B. Couch and A. H. Gold at the University of California reported rod-shaped particles in lettuce plants of the Bibb and Great Lakes varieties naturally infected by lettuce mosaic virus, and in the floral and vegetative tissues of Zinnia elegans and Tagetes erecta and in local lesions on Gomphrena globosa inoculated with the virus from lettuce (Phytopath. 44: 715).

In brown stele (cause undetermined), reported in Arizona, the stele of the tap-root assumes a brown color. A significantly greater amount of the disease was found in field plots which had received 40 tons of manure per acre than in control plots or in those which received 185 pounds of calcium nitrate per acre (R. B. Marlatt, PDR 39: 827).

Pink rib. R. B. Marlatt and J. K. Stewart described pink rib, cause apparently unknown, of head lettuce in the field and in storage in Arizona. This discoloration has been noticed during the last three years (1953-55) (PDR 40: 742).

LYCOPERSICON ESCULENTUM. TOMATO: In Wisconsin A. O. Paulus and G. S. Pound studied the effect of air temperature on initiation and development of gray leaf spot (Stemphylium solani) and nailhead spot (Alternaria solani) of tomato. Data from a survey during 1952 and 1953, when neither fungus was widespread, indicated that the prevailing temperatures in the State largely or entirely suppress the accumulation of grey leaf spot inoculum, while the incidence and distribution of nail-head spot are apparently restricted by the cultivation of resistant varieties (Phytopath. 45: 168). D. Davis and J. W. Rothrock discussed the practical advantages of the persistent localized systemic activity of griseofulvin in the control of tomato Alternaria blight (PDR 40: 328).

In New York M. E. Pantidou and W. T. Schroeder reported foliage as a source of secondary inoculum for tomato anthracnose (Colletotrichum phomoides). The tests yielded conclusive evidence, which was subsequently confirmed in the field, that diseased foliage provided sufficient inoculum to be of material importance in fruit infection (Phytopath. 45: 338).

D. F. Crossan and P. J. Lloyd reported field plot experiments on the relationship between overhead irrigation and the incidence, severity, and control of certain tomato diseases. Plots receiving 4 inches of water in a 30-day period had a significantly higher incidence of tomato anthracnose (Colletotrichum phomoides) and fruit rot (Rhizoctonia solani), but a significantly lower incidence of blossom-end rot. Maneb and zineb gave significant control of anthracnose under both irrigated and nonirrigated conditions, but maneb was more satisfactory than zineb under irrigation. Both materials appeared to decrease the severity of blossom-end rot in non-irrigated plots, but neither material controlled Rhizoctonia solani (PDR 40: 314).

Corynebacterium michiganense, bacterial canker. T. S. Pine and others, in an intensive study at the University of California on the pathological anatomy of bacterial canker of young tomato plants demonstrated that infection originated in the spiral vessel elements of the primary xylem (Phytopath. 45: 267).

At the University of Wisconsin J. R. Bloom and J. C. Walker studied the effect of nutrient sprays on Fusarium wilt (Fusarium bulbigenum var. lycopersici) of tomato. (Phytopath. 45: 443).

LYCOPERSICUM ESCULENTUM. TOMATO: Bert Lear and I. J. Thomason reported results with various soil fumigants for control of root-knot nematodes (Meloidogyne incognita acrita, M. javanica) affecting fresh fruit and canning tomatoes in California (PDR 40: 981).

Phytophthora capsici, foot rot. Mature tomato plants at Stockton, California were affected by foot rot. In experiments at the University of California the fungus caused a basal stem rot when the mycelium was added to the soil around the stems of young unwounded, potted Bonny Best tomato plants. It was demonstrated that the pathogen could survive for five months in moist soil in the absence of the host (P.D. Critopoulos, Bull. Torrey Bot. Club 82: 168).

Phytophthora infestans, late blight. In a comparison of three methods for the forecasting of late blight of potatoes and tomatoes, R. A. Hyre reported that hypothetical forecasts based on records from six stations in the northeastern States during the period 1949-54 showed that the method employing moving graphs derived from rainfall and temperature data are the most reliable (Amer. Potato Jour. 32: 362). World distribution and present status of tomato late blight was reported by P. R. Miller and M. J. O'Brien. This survey gives, for each country, the known history and a distribution map, with notes on occurrence and spread, damage, control measures and their effectiveness, strains and varietal resistance. A continental bibliography is included. New records for the mid-western and north-central States of America, and for Africa are reported (PDR Suppl. 231, 89 pp., 1955). According to the annual summary of the Plant Disease Warning Service, in 1955 late blight of potato and tomato was reported from many States and from Canada but was nowhere threatening or severe. In some cases where blight was reported on potato, no blight was observed on nearby tomatoes. No blight was found in either the green-wrap or transplant tomato areas of Georgia. On the whole, plants were relatively free from other diseases, which either developed later in the season or were completely absent. This year the total acreage for all diseases rejected for certification was the smallest since 1946. Experimental forecasts were again made with a high degree of accuracy in the North Central States. Experimental forecasts for potato blight were commenced in Aroostook County, Maine, this year, based on analyses of "moving" rainfall and temperature graphs.

Recent developments in the control of the major diseases of unstaked tomatoes grown on the sandy soils of south Florida were reported by J. F. Darby. A fungicidal program was suggested where the major foliage diseases are late blight (Phytophthora infestans), gray mold (Botrytis cinerea), bacterial spot (Xanthomonas vesicatoria), gray leaf spot Stemphylium solani), and ghost spot. (Florida Hort. Soc. Proc. 66: 103).

Sclerotium rolfsii, southern blight, occurred in experimental plots of Marglobe tomatoes located near Mobile, Alabama in July 1955. Only a few plants died, but many diseased fruits were collected from apparently healthy plants (Charles H. Driver, PDR 40: 259).

Xanthomonas vesicatoria, bacterial spot. Control of bacterial spot in tomato fields with streptomycin-Terramycin sprays was reported by R. A. Conover (PDR 39: 611).

In Ohio, the presence of tobacco mosaic virus on tomato seed was reported by C. A. John and C. Sova (Phytopath. 45: 636).

Occurrence of the destructive potato virus Y in tomato and pepper growing areas of southern Florida was correlated with commercial potato growing in the same areas, according to J. N. Simons and others (PDR 40: 531).

PASTINACA SATIVA. PARSNIP: Cercosporella pastinacae is the cause of leaf spot of parsnip, according to E. F. Guba. The names Ramularia pastinacae and Cercospora pastinacina are regarded as synonyms (PDR 39: 747).

PHASEOLUS LIMENSIS. LIMA BEAN: Phytophthora phaseoli, downy mildew. According to reports to the Plant Disease Warning Service, an extremely accurate forecast for the appearance of downy mildew of lima bean in Delaware this year was made by the warning service developed for this disease by R. A. Hyre. Dr. Hyre's prediction was for the appearance of lima bean downy mildew in Delaware beginning approximately September 1. The disease was found in overwintering plots at the University Farm, Newark, on September 2, and statewide surveys on September 7 and 8 showed it to be present in the Smyrna, Bridgeville, Milford, and Milton areas. During the last three weeks of September downy mildew increased considerably in the lower half of the State.

PHASEOLUS VULGARIS. BEAN: V. E. Wilson reported incidence of bean diseases in southern Idaho in 1955 (PDR 40: 312).

Xanthomonas phaseoli, bacterial blight. In New Jersey, R. A. Gray reported that the addition of 1 percent glycerin to streptomycin sprays greatly increased the effectiveness of the antibiotic against bacterial blight of Pinto beans. Increase in effectiveness was correlated with an increase in absorption of streptomycin by the leaves (PDR 39: 567).

J. R. Baggett discussed the inheritance of resistance to certain strains of the bean yellow mosaic virus in the interspecific cross Phaseolus vulgaris x P. coccineus, the runner bean (PDR 40: 702).

PISUM SATIVUM. PEA: D. J. deZeeuw and others reported results of three years' tests of fungicides, insecticides, and combinations of them, for seed treatment of peas and beans in Michigan (PDR 40: 727).

SOLANUM TUBEROSUM. POTATO: Harry C. Fink et al. reported results of 1955 seed piece treatments in Pennsylvania. Stands were usually increased by the treatments. In some cases treatment resulted in more rapid and more vigorous vine growth (PDR 40: 125).

In Connecticut, P. E. Waggoner reported results with streptomycin and other materials used alone and in combination for potato seed treatment (PDR 40: 411).

Erwinia atroseptica, blackleg. Streptomycin preparations gave good control of bacterial decay of potato seed-pieces, but encouraged growth of fungi, according to R. Bonde and J. F. Malcolmson (PDR 40: 615).

Heterodera rostochiensis, golden nematode. J. F. Spears and others reported evidence of persistence of the golden nematode in a field in New York in which potatoes had not been grown for nine years following soil treatment (PDR 40: 632).

Phytophthora infestans, late blight (see also under tomato). Hyre and Bonde reported that a survey of temperature and rainfall data and blight records for Maine covering the last 50 years showed that Hyre's modification of Cook's method for forecasting outbreaks of blight, used in other States, could have been applied with equal success in northern Maine. They stated that forecasting should now be attempted (Amer. Potato Jour. 32: 119). R. V. Akeley reported that the new, late maturing potato Merrimack proved resistant to the common race of late blight (P. infestans), moderately resistant to early blight (Alternaria solani), field immune from virus A, and highly resistant to net necrosis and to ring rot (Corynebacterium sepedonicum). They stated that in New England it should be planted as early in the spring as possible (Amer. Potato Jour. 32: 93). L. E. Heidrick reported important new developments in the breeding of potatoes for resistance to P. infestans, which include the use of wild species of Solanum from Central and South America and studies on physiologic specialization within the fungus and on the nature of resistance in the host (Phytopath. 45: 250). In June 1955 a survey of potato dumps was initiated to determine the incidence of the Kennebec race (1) and other races of P. infestans in diseased tubers in Maine, according to R. E. Webb and R. Bonde. Infected plants from 15 heaps yielded 11 races of the fungus, 10 of the 15 samples being mixtures of two or more races. Race 0 was found alone in only one sample, while races pathogenic to Kennebec were present in 11. In view of these findings the authors recommended adequate spraying for Kennebec and other varieties resistant to or immune from race 0 only (Amer. Potato Journ. 33: 53).

Streptomyces scabies, scab. Experimental potato scab control in Pennsylvania with Vapam and PCNB was discussed by Harry C. Fink (PDR 40: 190). Soil treatment with PCNB (Terraclor) gave good control of potato scab in eastern Virginia, according to T. J. Nugent (PDR 40: 428). Early Gem, a new early maturing potato, is reported to be highly resistant to scab, and may have some resistance to the purple top wilt, but seems susceptible to all other major potato diseases. It can be used in most scab-infested soils if these are properly drained and not too heavy (F. J. Stevenson, and others. Amer. Potato Jour. 32: 79). G.H. Rieman and D. A. Young reported that the University of Wisconsin has released a new variety of potato, Antigo, resistant to scab which is very serious in Wisconsin. The variety is medium-maturing, of average yielding ability, and suited to the muck soils in the State (Amer. Potato Journ. 32: 407).

In Connecticut, Paul E. Waggoner reported variation in pathogenicity of isolates of Verticillium albo-atrum from potato (PDR 40: 429).

Leafroll (virus). In New York at the Rockefeller Institute, K. Maramorosch reported on seedlings of potato as indicator plants for potato leafroll virus. Infective aphids (Myzus persicae) were confined in celluloid cages on seedlings about 3 inches high for one week. The first symptoms, consisting of rolled leaves and stunting, appeared in four days (Amer. Potato Jour. 32: 49). In Maine R. E. Webb, E. S. Schultz and R. V. Akeley reported some variations in symptomatology and transmission of leafroll of potato. (Amer. Potato. Jour. 32: 60).

R. E. Webb described wilting as an atypical primary leafroll symptom in one potato seedling variety (PDR 40: 15).

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

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SUPPLEMENT 242

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Supplement 242

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

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paeolum majus: Heterosporium tro-

ERRATA

On page 88, under 1. Dieffenbachia picta Schott, 2nd paragraph, 4th line, read who maintains pathogen-free stock, instead of who maintains pathogen-stock.

On page 89, under 2. 3rd paragraph 7th line read removed to reduce invasion by Botrytis cinerea instead of removed to reduce to reduce invasion by Botrytis cinerea.

On page 205 read Agropyron inerme instead of Agropyron inerne.

On page 221, 10th line read Pseudopityophthorus minutissimus instead of Pseudopityophthorous minutissimus.

In Supplement 237. "Host Index and Morphological Characterization of the Grass Rusts of the World" one page of the data tabulations is out of place. Page 44 belongs at the end of Group V. The following corrections should be made:

1. Annotate the bottom of page 41 as follows: "(see page 44 for the remainder of group V)."
2. Bottom of page 43 add: "Group VI continued on page 45."
3. Top of page 44 add: "Group V, continued."
4. Top of page 45 add: "Group VI, continued."

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