The Unattached Aecial Forms of Plant-rusts in North America.

By A. G. Johnson.

Ever since the definite establishment of heteroecism in the Uredinales by DeBary in 1864 and 1865, many different aecial forms have been, one by one, properly connected with their respective telial forms, so that now the proper relationships are definitely known for a large number. On the other hand, there still remain a considerable number of aecial forms whose telial connections are still unknown.

The aecial forms of Uredineae are included mainly under the form-genera of *Caeoma, Peridermium, Roestelia* and *Accidium.* In this paper the treatment will be limited to the last named form-genus, viz: *Accidium.*

The genus *Accidium* was established by Persoon in Linné, Systema Naturae **2**:1472. 1791, by the following brief generic description: "Theca (membranacea) utrinque glabra seminibus nudis non cohaerentibus plena." As now most generally accepted the diagnostic characters of the genus are: a more or less cupulate peridium, rupturing at apex, within which spores are borne in chains.

The genus was at first considered distinct and independent by the early botanists, yet practical farmers had for a long time observed and recognized the connection between rusted barberry bushes and rust on wheat in the fields, and were very certain that the former was a direct cause of the latter. To the end of protecting wheat from the disease due to this origin, a strict law providing for the destruction of all barberry bushes in Massachusetts was enacted as early as 1755, the same to take effect in 1760 and be in force for practically four years. Following this, various observations were made and experiments performed by different men, with varying degrees of conclusiveness. While observations and experiments had been previously made by Schroeter in 1816, DeBary was the first to show conclusively the exact succession of spore-forms in the life history of a heteroecious rust. He showed definitely by experiments

that aeciospores were produced on *Berberis* from infections from teliospores of *Puccinia poculiformis* from wheat, and thus definitely established heteroecism in the Uredineae in 1864. He also showed that urediniospores followed by teliospores were produced on wheat by sowing aeciospores from the barberry. DeBary's radical discovery was rather slow in being accepted by many other botanists, yet his evidence was indisputable and his interpretation prevailed.

Oersted, working independently and contemporaneously with DeBarry, established similar alteration of spore forms on different hosts between the genera *Gymnosporangium* on cedars and *Roestelia* on the apple family.

This was epoch-making work in this line and showed the necessity for accurate observations and most careful cultures to show the definite relationships of the different aecial forms. This work was taken up by botanists both in the old and new world and is still being carried on with much success. Early workers in Europe, beside DeBary and Oersted, were Fuckel, Magnus, Schröeter, Wolff, Rostrup, Winter, Nielson, Reichardt, Hartig, Rathay, Cornu and Plowright. More recent workers of the old world are Fischer, Klebahn, Tranzschel, von Tubeuf, Wagner, Bubak, Juel, Hennings, Eriksson, Dietel, Liro and others.

In America Farlow and Thaxter did pioneer work, followed later, and with greater success, in this line by Arthur, Kellerman, Clinton, Kern and others. The work of Dr. J. C. Arthur stands out prominently above all others.

The methods used by the different workers are, in the main, very similar, viz: germinable spores of one stage are placed on sterile plants of the suspected alternate host. Conditions of heat and moisture being kept as favorable as possible throughout. In the methods used by Dr. Arthur, the perfectly healthy potted plants are kept covered with bell-jars for three days after the spore sowing is made. Each day the bell-jars are removed for five minutes or so to allow the entrance of a fresh supply of air, after which they are sprinkled within and replaced over the plants, and the plant thus covered is left in a shaded place until about a day after the bell-jar is removed. The inoculated leaves are then kept well moistened and kept out of too strong light and carefully watched for spore developments, especially after the first week. If the culture is successful the first spore structure will usually be evident in a week or ten days, followed later by the second spore structure, when that is pres-

ent, and thus showing definitely that the two alternate phases on wholly different plants belong to the same species of fungus.

Thus a large number of aecia have been properly assigned to their telial connection, and still many others remain to be thus connected.

At first the species of *Aecidium* were placed in groups largely according to hosts, but as they were studied more closely, both microscopically and in cultures, it was found that often there occurred many forms on the same family of host plants, and often on the same host genus, several distinct species could be segregated. Even on the same host-species it was not infrequent to find more than one species of *Aecidium*. As certain of these aecia were properly referred to their telial connections, these were separated as carefully as possible from the unattached forms and the latter remained to be studied further. In certain cases the definite morphological characters of the forms that are properly connected with their telial stages have made it possible to segregate definitely the attached forms from the unattached forms. In other cases where the morphological differences are less distinctive, and where certain physiological differences exist, the separation between the attached and unattached forms has been less definite, and in some cases it is impossible to make such separation with certainty until further cultures are made in order to help decide the matter. In making such separation of attached from unattached forms it is clear then that it is necessary to take into consideration not only the morphological characters of a species but also its physiological behavior in cultures.

It has been the purpose of this study to make such separation, farther than it had already been made, and to determine as far as possible the number of forms still unattached and to work out clues for probable connection wherever possible.

The forms of aecia whose telial connections still remain unknown, are arranged and follow in the form of an annotated list preceded by a provisional key, for convenience of reference. Under each species are given as far as possible the citation of the original description and date of publication, the hosts inhabited, the states and provinces in which the species has been found on each host, the type locality, type host, general distribution, and reference by number to specimens published in sets of exsiccati. Notes follow in most cases, especially where the form is especially striking, or where there are clues to relationship, or where there

is some question as to the definiteness regarding the placement of the form in the unattached list. Notes are also added in some other cases.

The arrangement in the list is according to host families and genera in the sequence used in Britton and Brown's Illustrated Flora of the Northern States and Canada, supplemented by Engler and Prantl's Natürliche Pflanzen-familien in cases where the host is not within the range of the former work. The provisional key precedes this list and follows in this connection.

KEY TO THE UNATTACHED SPECIES OF AECIDIUM IN NORTH AMERICA.

I. Aecia scattered, arising from diffused mycelium:
- Host belonging to Urticaceae ..... *A. libertum* 10
- Host belonging to Chenopodiaceae ..... *A. Eurotiae* 12
- Host belonging to Caryophyllaceae ..... *A. Cerastii* 15
- Host belonging to Fumariaceae ..... *A. Dicentrae* 27
- Host belonging to Malvaceae:
  - Aeciospores with thin walls:
    - Peridia fugacious, aecia more or less elliptical in outline ..... *A. tuberculatum* 48
    - Peridia less fugacious, aecia practically circular in outline ..... *A.* sp. 49
  - Aeciospores with very thick walls..... *A. intervenicus* 50
- Host belonging to Holoragidaceae ..... *A. Prospinaceae* 59
- Host belonging to Boraginaceae ..... *A. Myosotidis* 69
- Host belonging to Solonaceae ..... *A. Physalidis* 72
- Host belonging to Scrophulariaceae ..... *A. Collinsiae* 77
- Host belonging to Valerianaceae ..... *A. Valerianellae* 86
- Host belonging to Cichoriaceae ..... *A. Columbiense* 90

II. Aecia gregarious, arising from a limited mycelium:
- Host belonging to Scheuchzeriaceae ..... *A. Triglochinis* 1
- Host belonging to Melanthaceae ..... *A. Uvulariae* 2
- Host belonging to Liliaceae:
  - Of the genus Leucocrinum ..... *A.* sp. 3
  - Of the genus Anthericum ..... *A.* sp. 4
- Host belonging to Convallariaceae ..... *A. Trillii* 5

Host belonging to Scrophulariaceae:
Of the genus Chelone .....*A. Chelonis* 75
Of the genus Pentstemon .....*A. Palmeri* 76
Of the genus Afzelia, or Dasystoma.....*A. Gerardiae* 78
Of the genus Castilleja .....*A. micropunctum* 79
Of the genus Melampyrum .....*A.* sp. 80
Host belonging to Acanthaceae .....*A. Tracyanum* 81
Host belonging to Rubiaceae:
Of the genus Houstonia .....*A. Oldenlandianum* 82
Of the genus Bouvardia .....*A. Bouvardiae* 83
Of the genus Randia .....*A. pulverulentum* 84
Host belonging to Caprifoliaceae .....*A. Triostei* 85
Host belonging to Cichoriaceae:
Of the genus Lygodesmia .....*A. Lygodesmiae* 87
Of the genus Crepis .....*A. crepidicolum* 88
Of the genus Hieracium .....*A. Hieraciatum* 89
Host belonging to Ambrosiaceae .....*A.* sp. 91
Host belonging to Carduaceae:
Of the genus Laciniaria .....*A. Liatridis* 92
Of the genus Boltonia .....*A. Boltoniae* 93
Of the genus Clibadium .....*A. Clibadii* 94
Of the genus Montonoa .....*A. Montonoae* 95
Of the genus Wedelia .....*A. Wedeliae* 96
Of the genus Bahia, or Eriophyllum.....*A. Bahiae* 97
Of the genus Senecio:
Peridia short, not lacerate:
Aecia rather small .....*A. Senecionis* 98
Aecia rather large .....*A.* sp. 99
Peridia long, coarsely lacerate .....*A. Herrerianum* 100
Of the genus Coleosanthus, Chrysogonum, Chrysothamnus, Dugaldia, Helenium, Polymnia, or Rudbeckia.....*A. compositarum* 101

1. *Accidium Triglochinis* D. & H. Erythea 7:98. 1899.

On SCHEUCHZERIACEAE:

Triglochin concinna Davy, California.

Triglochin sp., Nevada.

TYPE LOCALITY: Amedee, California, on *Triglochin concinna*.

DISTRIBUTION: Known only from Nevada and California.

There are no clues as to the relationship of this *Accidium*. It has, however, the habit of a heteroecious form.

2. *Accidium Uvulariae* Schw. Schr. Nat. Ges. Leipzig 1:69. 1822.

On MELANTHACEAE:

Uvularia grandiflora J. E. Smith, Iowa.

Uvularia perfoliata L., Iowa, Missouri, North Carolina.

Uvularia sessiliflora L., Delaware.

TYPE LOCALITY: Salem, North Carolina, on *Uvularia perfoliata*.

DISTRIBUTION: Delaware and North Carolina west to Iowa and Missouri.

Very similar to *Accidium Majanthae Schum.* with which it may belong. Cultures are necessary to determine the standing of these closely related forms.

3. *Accidium* sp.

On LILIACEAE:

Leucocrinum montanum Nutt., Colorado.

DISTRIBUTION: Known only from Colorado.

There are no definite clues as to the relationship of this *Accidium*, but its telial stage is most likely to be a *Puccinia* on some grass.

4. *Accidium* sp.

On LILIACEAE:

Anthericum nanum Baker, Mexico.

Only one, the collection from the State of Mexico, known.

5. *Accidium Trillii* Burr. Bot. Gaz. 9:190. 1884.

On CONVALLARIACEAE:

Trillium grandiflorum (Michx.) Salisb., New York.

Trillium recurvatum Beck., Illinois.

TYPE LOCALITY: Pine Hills, Union Co., Illinois, on *Trillium recurvatum*.

Closely related to *Accidium Majanthae* Schum. with some race of which it may prove eventually to belong. Cultures are necessary to determine the point.

6. *Accidium Zephyranthis* Shear, Bull. Torr. Bot. Club **29**:454. 1902.

On AMARYLIDACEAE:

Zephyranthes sp., Hidalgo, Mexico.

TYPE LOCALITY: Near Tlalpam, Valley of Mexico, Mexico, on *Zephyranthes* sp.

DISTRIBUTION: Central Mexico.

7. *Accidium Iridis* Ger. Rep. N. Y. Mus. **24**:93. 1872.

On IRIDACEAE:

Iris versicolor L., Iowa, New York, Massachusetts, Minnesota, Nebraska, Wisconsin.

TYPE LOCALITY: Poughkeepsie, New York, on *Iris versicolor*.

DISTRIBUTION: New York, Massachusetts, west to Minnesota and Nebraska.

EXSICCATI: Ellis, N. Am. Fungi *1014;* Roum. Fungi. Sel. *4917;* Rab.-Wint. Fungi Eur. *2927;* Thüm. Myc. Univ. *1519*.

There is considerable question as to the relationship of this *Accidium*. It is very uncertain if it belongs with *Puccinia Iridis* (DC.) Wint. on the same host. It has been suggested that it may belong with a *Carex*-inhabiting *Puccinia*. Cultures are necessary to settle the point.

8. *Accidium Myricatum* Schw. Trans. Am. Phil. Soc. II. **4**:294. 1832.

On MYRICACEAE:

Myrica cerifera L., Delaware, New Jersey, New York.

Myrica Carolinensis Mill., Connecticut, New Jersey.

TYPE LOCALITY: New York, on *Myrica cerifera*.

DISTRIBUTION: New York, New Jersey, Connecticut and Delaware.

EXSICCATI: Ellis, N. Am. Fungi *230;* Ellis & Ev. Fungi Columb. *62:* Roum. Fungi Sel. *4835;* Thüm. Myc. Univ. *1224*.

A conspicuous, characteristic *Accidium* of rather limited range.

9. *Aecidium Boehmeriae* Arth. Bull. Torr. Bot. Club **34**:590. 1907.

On URTICACEAE:

Boehmeria cylindrica (L.) Willd., District of Columbia.

TYPE LOCALITY: Takoma Park, District of Columbia, on *Boehmeria cylindrica*.

DISTRIBUTION: Known only from type locality.

This is very similar to *Accidium Urticae* Schum., which is connected with *Puccinia Caricis* (Schum.) Schröt. on *Carex*, except for having smaller aeciospores and peridia more delicate in general. Repeated trial sowings of *Puccinia Caricis* on *Boehmeria* have uniformly failed, while infections have been easily obtained on *Urtica*. This species of *Accidium* is therefore no doubt distinct and may belong with some other *Carex*-inhabiting *Puccinia*.

10. *Accidium libertum* Arth. Bull. Torr. Bot. Club **37**:580. 1910.

On URTICACEAE:

Urtica chamaedryoides Pursh, Oklahoma.

TYPE LOCALITY: Sapulpa, Oklahoma [Indian Territory], on *Urtica chamaedryoides*.

DISTRIBUTION: Known only from type locality.

A very characteristic species. No clues as to possible telial connection. It may, however, belong with some telial form inhabiting some host other than a grass or sedge.

11. *Accidium* sp.

On LORANTHACEAE:

Loranthus sp., Guatemala.

This is doubtless an undescribed species. It does not agree with previously described species on this host.

12. *Accidium Eurotiae* E. & E. Jour. Myc. **6**:119. 1891.

On CHENOPODIACEAE:

Eurotia lanata (Pursh) Moq. Montana, New Mexico, Wyoming.

TYPE LOCALITY: Helena, Montana, on *Eurotia lanata*.

DISTRIBUTION: Montana south to New Mexico.

EXSICCATI: Ellis & Ev. N. A. F. *2709;* Ellis & Ev. Fungi Columb. *271*.

13. *Accidium Abroniae* Ellis & Everhart n. sp. (Ined.)

On ALLIONIACEAE:

Abronia (micrantha (Torr.) Chois.?), Colorado.

Abronia umbellata Lam., California.

TYPE LOCALITY: Ft. Collins, Colorado, on *Abronia* sp.

DISTRIBUTION: Colorado and westward.

As far as the writer can determine this species has never been published. The name appears to be only an herbarium name by Ellis & Everhart. The species is no doubt distinct.

14. *Accidium Mirabilis* D. & H. Bot. Gaz. **24**:37. 1897.

On ALLIONIACEAE:

Mirabilis sp., Mexico.

TYPE LOCALITY: Rio Hondo, near City of Mexico, Mexico, on *Mirabilis* sp.

DISTRIBUTION: Known only from type locality.

No specimen seen.

15. *Accidium Cerastii* Wint. Jour. Myc. **1**:126. 1885.

On CARYOPHYLLACEAE:

Cerastium nutans Raf., Missouri.

TYPE LOCALITY: Perryville, Missouri, on *Cerastium nutans*.

DISTRIBUTION: Known only from Missouri.

A rare species of the typical perrennial type judging from the description, no specimen has ever been examined.

16. *Accidium* sp.

On RANUNCULACEAE:

Caltha leptosepala DC., British Columbia.

DISTRIBUTION: Only one collection known.

Probably followed by the telial stage, (*Puccinia*), on the same host, only not yet collected.

This is doubtless a new species collected by Professor E. W. D. Holway on north moraine, Mt. Sanford, Glacier, British Columbia, July, 1910.

17. *Accidium Cimicifugatum* (Schw.) Berk. Grev. **3**:60. 1874.

Caeoma (Accidium) Cimicifugatum Schw. Trans. Am. Phil. Soc. II. **4**:293. 1832.

Accidium Actaeae Authors. Not Opiz.

On RANUNCULACEAE:

Cimicifuga racemosa (L.) Nutt. (*Actaea racemosa* L.), Pennsylvania, New York, Ohio, Virginia; Ontario.

Actaea alba (L.) Mill., Iowa, Minnesota, Ohio, Wisconsin.

Actaea rubra (Ait.) Willd. (*A. spicata rubra* Ait.), New York.

TYPE LOCALITY: Bethlehem, Pennsylvania, on *Cimicifuga racemosa.*

DISTRIBUTION: United States east of the Mississippi River, especially northward.

EXSICCATI: Ravenel, Fungi Car. 1:94; Sydow, Ured. *1343;* Rab.-Wint. Fungi Eur. *3420;* Kellerm. Ohio Fungi *61;* Ellis, N. Am. Fungi 227.

18. *Aecidium Delphinii* Barth. Jour. Myc. 8:173. 1902.

Aecidium Batesianum Barth. Ellis & Everhart's Fungi Columb. 20:1901. 1904.

On RANUNCULACEAE:

Delphinium albescens Rydb., Nebraska.

Delphinium bicolor Nutt., Montana.

Delphinium Carolinianum Walt. (*D. azureum* Michx.), Colorado.

Delphinium cuculatum A. Nelson, Montana.

Delphinium geraniifolium Rydb., Colorado.

Delphinium Geyeri Greene, Colorado.

Delphinium Nelsoni Greene, Idaho.

Delphinium robustum Rydb., Colorado, Nebraska.

DISTRIBUTION: Colorado and northward.

TYPE LOCALITY: Steamboat Springs, Colorado, on *Delphinium scopulorum,* later referred to *D. geraniifolium.*

EXSICCATI: Ellis & Ev. Fungi Columb. *1901;* Clements, Crypt. Form. Colo. *151.*

This *Aecidium* becomes very abundant in Colorado some years. Its telial connection is probably some grass-inhabiting *Puccinia.* In 1907, Dr. J. C. Arthur and Mr. F. D. Kern found it "growing intermixed with *Elymus condensatus* covered with *Puccinia montanensis,*" and this may prove to be the connection.

19. *Aecidium Aconiti-Napelli* (DC.) Wint. Die Pilze p. 268. 1881.

On RANUNCULACEAE:

Aconitum Columbianum Nutt., Colorado.

Aconitum sp., Colorado.

DISTRIBUTION: Known from Colorado only.

EXSICCATI: Ellis & Ev. N. Am. Fungi *2212*.

This *Accidium* is very similar to *Accidium Delphinii* Barth. with which it may ultimately prove to be identified.

20. *Accidium circinans* Erikss. Bot. Centralbl. n. **36**:297. 1891.

On RANUNCULACEAE:

Aconitum Delphinifolium DC., Alaska.

TYPE LOCALITY: Sweden, on *Aconitum Lycoctonum* L.

DISTRIBUTION: Known only from Alaska. Also in Europe.

Little is known regarding this *Accidium*. It may prove to be the aecial stage of an autoecious *Uromyces* similar to *Uromyces Aconiti-Lycoctoni* (DC.) Wint., the aecial stage of which it greatly resembles.

21. *Accidium Anemones* Am. Authors.

On RANUNCULACEAE:

Anemone narcissiciflora L., Alaska.

Anemone Virginiana L., Indiana, Iowa, Wisconsin; Ontario.

DISTRIBUTION: Northern Mississippi and northward.

22. *Accidium occidentale* Arth. Bull. Torr. Bot. Club **31**:7. 1904.

On RANUNCULACEAE:

Viorna Douglasii (Hook.) (*Clematis Douglasii* Hook.), Idaho, Washington.

Viorna Wyethii (Nutt.) Rydb., Montana, Washington.

TYPE LOCALITY: Pullman, Washington, on *Clematis Douglasii*.

DISTRIBUTION: Montana to Washington.

23. *Accidium Ranunculacearum* DC. (in part).

On RANUNCULARACEAE:

Ranunculus ellipticus Greene, North Dakota.

Ranunculus glaberrimus Hook., Idaho, Montana, Washington.

Ranunculus sceleratus L., North Dakota.

DISTRIBUTION: Northern Mississippi valley west to Washington.

The aecia on the above named hosts resemble very closely the *Accidium* on *Oxygraphis Cymbalaria* (Pursh) Prantl. which belongs with *Puccinia cinerea* Arth. on *Poa*, and may be shown by cultures to belong with it. This is especially likely since its range practically coincides with that of this *Puccinia*.

24. *Accidium Ranunculaccarum* DC. (in part).

On RANUNCULACEAE:

Cyrtorhyncha ranunculina Nutt., Colorado.

Ranunculus bulbosus L., Connecticut.

Ranunculus recurvatus Poir., Missouri.

DISTRIBUTION: Connecticut west to Colorado and Missouri.

These differ slightly from the preceding by the peridia being much less crowded and the substratum not being thickened. They may prove to be different.

25. *Accidium Thalictri* Am. Authors.

On RANUNCULACEAE:

Isopyrum biternatum (Raf.) T. & G., Iowa.

Syndesmon thalictroides (L.) Hoffm., Indiana, Missouri.

Thalictrum dioicum L., Massachusetts, Minnesota, Vermont.

Thalictrum polygamum Muhl., Colorado.

Thalictrum purpurascens L., Nebraska, South Dakota, Wisconsin.

Thalictrum thyrsoideum Greene, North Dakota.

Thalictrum sp., Idaho; Newfoundland.

DISTRIBUTION: Northern United States and Canada.

EXSICCATI: Barth. Fungi Columb. *2405;* Brenckle, Fungi Dak. *104;* Ellis & Ev. Fungi Columb. *1390;* Rab.-Wint. Fungi Eu. *3322;* Rab.-Wint.-Paz. Fungi Eu. *3836.*

The aecia on *Thalictrum* and related hosts are very closely related, and cultures are necessary to segregate them with certainty. These placed together here are slightly different as to form and habit from those already connected with *Bromus* and *Agropyron*-inhabiting *Puccinae.*

26. *Accidium Fendleri* Tracy & Earle, Pl. Baker. 1:17. 1901.

On BERBERIDACEAE:

Berberis Fendleri A. Gray, Colorado.

TYPE LOCALITY: Mancos, Colorado, on *Berberis Fendleri.*

DISTRIBUTION: Known only from Colorado.

This differs slightly in habit from *Accidium Berberidis* and may prove distinct, although it is very similar.

27. *Accidium Dicentrae* Trel. Trans. Wis. Acad. Sci. 6:136. (Nov.) 1884.

Accidium Dicentrae Burr. Bot. Gaz. 9:189. (Dec.) 1884.

On FUMARIACEAE:

Dicentra Cucullaria (L.) Bernh., Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, New York, Pennsylvania, South Dakota, Wisconsin.

TYPE LOCALITY: Madison, Wisconsin, on *Dicentra Cucullaria*.

EXSICCATI: Ellis & Ev. Fungi Columb. *1903;* Kell. & Swingle, Kans. Fungi *2;* Sydow, Ured. *497*.

A characteristic species of wide range. It doubtless has its telial stage on some host other than a grass or sedge. Its pycnia are subcuticular.

28. *Accidium* sp.

On SAXIFRAGACEAE:

Mitella nuda L., Newfoundland.

Only the one collection known from Shoal Point, Bay of Islands, Newfoundland. No doubt a distinct species.

29. *Accidium Parnassiae* (Schl.) Grav. Duby Bot. Gall. **2**:904. 1830. *Caeoma Parnassiae* Schl. Fl. Berol. **2**:113. 1824.

On PARNASSIACEAE:

Parnassia palustris L., Alaska.

TYPE LOCALITY: Berlin, Germany, on *Parnassia palustris*.

DISTRIBUTION: In America, known only from Alaska.

In Europe this is considered the aecial stage of *Puccinia uliginosa* Juel, which it may also prove to be in America.

30. *Accidium* sp.

Accidium Cassiae E. & K. Trans. Kans. Acad. **10**:91. 1887. (nomen nudem) not *Acc. Cassiae* Bres.

On CAESALPINACEAE:

Cassia Chamaecrista L., Kansas, Nebraska.

TYPE LOCALITY: Manhattan, Kansas, on *Cassia Chamaecrista*.

DISTRIBUTION: Central Mississippi valley.

This *Accidium* differs decidedly from *Acc. Cassiae* Bres. in having considerably smaller spores than the African species, and is without question distinct from it. Ellis & Kellerman's name was never established, as far as the writer can determine and not now an available one. This being the case, this *Accidium* is still unnamed

31. *Accidium Kellermanni* DeT. Sacc. Syll. **7**:788. 1888.

Accidium amphigenum Ellis & Kell. Jour. Myc. **2**:4. 1886. not *A. amphigenum* Hazsl. 1877.

On FABACEAE:

Baptisia australis (L.) R. Br., Kansas.

Baptisia bracteata Ell. (*B. leucophaea* Nutt.), Kansas.

TYPE LOCALITY: Manhattan, Kansas, on "*Baptisia leucophaea.*"

DISTRIBUTION: Known only from Kansas.

32. *Accidium Onobrychidis* Burrill, Bot. Gaz. **9**:189. 1884.

On FABACEAE:

Psoralea onobrychis Nutt., Illinois.

TYPE LOCALITY: LaSalle County, Illinois, on *Psoralea onobrychis.*

DISTRIBUTION: Known only from Illinois.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1826.*

This is no doubt heteroecious and probably belongs with some unattached *Uromyces.* It is characteristically distinct from the aecial stage of *Uromyces Psoraleae* Pk., which has scattered aecia and is followed by teliospores, without an intervening uredinial stage.

33. *Accidium Dalcae* Kellerm. & Sw. Jour. Myc. **5**:13. 1889.

On FABACEAE:

Paroselа emmeandra (Nutt.) Britton (*Dalea laxiflora* Pursh), Kansas, Nebraska.

TYPE LOCALITY: Rockport, Kansas, on "*Dalea laxiflora.*"

DISTRIBUTION: Nebraska and Kansas.

EXSICCATI: Barth. Fungi Columb. *3301;* Shear, Ell. & Ev. Fungi Columb. *1473;* Sydow, Ured. *1448.*

A characteristic species. Very abundant in Kansas some seasons, becoming rather destructive to host plants.

34. *Accidium Pctalostemonis* Kellerm. & Carl.; Arth. Bull. Torr. Bot. Club **34**:589. 1907.

Accidium fluxum Arth. Bull. Torr. Bot. Club **34**:590. 1907.

On FABACEAE:

Petalostemon candidus (Willd.) Michx., Kansas, Nebraska.

Petalostemon multiflorus Nutt., Kansas.

Petalostemon oligiophyllus (Torr.) Rydb., Nebraska.

Petalostemon purpureus (Vent.) Rydb. (*P. violaceus* Michx.), Kansas, Nebraska.

Petalostemon villosus Nutt., Colorado, Nebraska.

TYPE LOCALITY: Manhattan, Kansas, on *Petalostemon candidus.*

DISTRIBUTION: Nebraska and Kansas west to Colorado.

EXSICCATI: Barth, Fungi Columb. *2296, 2497, 2604, 2903;* Clements. Crypt. Form. Colo. *595;* Ellis & Ev. N. Am. Fungi *1845.*

Similar to Aecidium Daleae K. & S. in general habit, but has thinner walled and slightly smaller aecispores. It is no doubt distinct and heteroecious.

35. *Aecidium Lupini* Peck, Rep. N. Y. State Mus. **46**:33. 1893.

On FABACEAE:

Lupinus perennis L., New York.

TYPE LOCALITY: Karner, New York, on *Lupinus perennis.*

DISTRIBUTION: Known only from the type locality.

This form differs somewhat from the aecia common in the western mountains belonging to *Uromyces Lupini* B. & C. The type locality is within a few miles of Albany, and it is difficult to explain why it has not been met with a second time.

36. *Aecidium Falcatae* Arth. Bull. Torr. Bot. Club **33**:32. 1906.

On FABACEAE:

Falcata comosa (L.) Kuntze (*Amphicarpa monoica* Ell.), Illinois, Iowa, Minnesota, Wisconsin.

Apios Apios (L.) MacM. (*A. tuberosa* Moench.), Iowa, Minnesota, Nebraska.

TYPE LOCALITY: Decorah, Iowa, on *Falcata comosa.*

DISTRIBUTION: Upper Mississippi valley.

EXSICCATI: Barth. Fungi Columb. *2303;* Barth. N. Am. Ured. *1;* Ellis, N. Am. Fungi *1436.*

A distinct species, probably of some *Uromyces* connection.

37. *Aecidium violascens* Trel.; Sacc. Pk. & Trel. Harriman Alaska Exped. **5**:37. 1904.

On GERANIACEAE:

Geranium erianthum DC., Alaska.

TYPE LOCALITY: Kadiak, Alaska, on *Geranium orianthum*.

DISTRIBUTION: Known only from Alaska.

This differs from *Aecidium sanguinolentum* Lindr., which belongs with *Puccinia polygoni-amphibii* Pers., in having the peridia less exserted and less recurved, and in having larger spores.

38. *Aecidium Byrsonimatis* P. Henn. Hedwigia 34:101. 1895.
Aecidium byrsonimaticola P. Henn. Hedwigia 34:322. 1895.
Endophyllum singulare Diet. & Holw. Bot. Gaz. 31:336. 1901.
Aecidium Byrsonimae Kern & Kellerm. Jour. Myc. 13:24. 1907.

On MALPIGHIACEAE:

Byrsonima crassifolia (L.) DC., Guatemala, Jalisco.

TYPE LOCALITY: Goyaz, Brazil, on *Byrsonima* sp.

DISTRIBUTION: Central Mexico and southward. Also in South America.

A strikingly characteristic form with conspicuous peridia; often produces hypertrophy.

39. *Aecidium Xanthoxyli* Peck, Bot. Gaz. 6:275. 1881.

On RUTACEAE:

Xanthoxylum americanum Nutt., Iowa, Kansas, Missouri, Nebraska.
Xanthoxylum Clava-Herculis L. (*X. Caroliniannum* Lam.), Texas.
Xanthoxylum Clava-Herculis fruticosum (A. Gray) S. Wats., Alabama.

TYPE LOCALITY: Decorah, Iowa, on *Xanthoxylum americanum*.

DISTRIBUTION: Iowa and Nebraska south to Texas and Alabama.

EXSICCATI: Carleton, Ured. Am. *6;* Barth. N. Am. Ured. *102;* Ellis, N. Am. Fungi *1013;* Ellis & Ev. Fungi Columb. *1477;* Rab.-Wint. Fungi Eur. *2928;* Sydow, Ured. *1578*.

A characteristic species, probably belonging with some grass-inhabiting *Puccinia*.

40. *Aecidium polygalinum* Peck, Bot. Gaz. 6:275. 1881.

On POLYGALACEAE:

Polygala Senega L., Iowa, Michigan, Wisconsin.

TYPE LOCALITY: Ann Arbor, Michigan, on *Polygala Senega*.

DISTRIBUTION: Upper Mississippi valley.

EXSICCATI: Ellis, N. Am. Fungi *1009;* Rab.-Wint. Fungi. Eur. *3319;* Sydow, Ured. *1396.*

A distinct species of rather limited range.

41. *Accidium crotonopsidis* Burr. Bot. Gaz. 9:190. 1884.

Accidium splendens Wint. Rab.-Wint. Fungi Eur. *3224.* 1885.

On EUPHORBIACEAE:

Croton monanthogynus Michx., Illinois, Missouri.

Crotonopsis linearis Michx., Illinois.

TYPE LOCALITY: Johnson County, Illinois, on *Crotonopsis linearis.*

DISTRIBUTION: Central Mississippi valley.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1824;* Rab.-Wint. Fungi Eur. *3224;* Roum. Fungi Gall. Exs. *3860.*

No doubt a heteroecious species.

42. *Accidium Argithamniae* Arth. Bull. Torr. Bot. Club 33:33. 1906.

On EUPHORBIACEAE:

Argithamnia Schiediana Müll.-Arg., Hidalgo.

TYPE LOCALITY: Trinidad, State of Hidalgo, Mexico, on *Argithamnia Schiediana.*

DISTRIBUTION: Known only from the type locality.

43. *Accidium* sp.

On EUPHORBIACEAE:

Mozinna spathulata (Müll.-Arg.) Ortega (*Jatropha spathulata* Müll.-Arg.), Guanajuato.

DISTRIBUTION: Only one collection known.

Doubtless a distinct species of heteroecious connection.

44. *Accidium Stillingiae* Tracy & Earle, Bull. Torr. Bot. Club 26:492. 1899.

On EUPHORBIACEAE:

Sebastiana ligustrina (Michx.) Muell.-Arg. (*Stillingia ligustrina* Michx.). Mississippi.

Stillingia sylvatica L., Florida.

TYPE LOCALITY: Wisdom, Mississippi, on "*Stillingia ligustrina.*"

DISTRIBUTION: Mississippi to Florida.

45. *Accidium Aesculi* Ellis & Kell. Bull. Torr. Bot Club **11**:114. 1884.

On HIPPOCASTANACEAE:

Aesculus arguta Buckley, Kansas.

Aesculus glabra Willd., Kansas, Nebraska.

TYPE LOCALITY: Manhattan, Kansas, on *Aesculus glabra.*

DISTRIBUTION: Central Mississippi valley.

EXSICCATI: Barth. Fungi Columb. *2301;* Ellis, N. Am. Fungi *1429;* Ellis & Ev. Fungi Columb. *1296;* Kell. & Swingle, Kans. Fungi *1;* Roum. Fungi Gall. *3865;* Sydow, Ured. *1198.*

Bartholomew (Trans. Kans. Acad. Sci. **16**:186.) reports that this striking *Accidium* was so abundant on several small trees of *A. arguta* in Rooks County, Kansas, in 1897, that it became quite destructive.

46. *Accidium mexicanum* D. & H. Bot. Gaz. **24**:36. 1897.

On VITACEAE:

Cissus sp., Mexico.

TYPE LOCALITY: Near City of Mexico, Mexico, on *Cissus* sp.

DISTRIBUTION: Known only from type locality.

Distinguishable from *Acc. Cissi* Wint. by having larger spores.

47. *Accidium Cissi* Wint. Hedwigia **23**:168. 1884.

On VITACEAE:

Cissus sicyoides L., Guatemala, Jamaica, Porto Rico.

TYPE LOCALITY: Near Sao Francisco, Brazil, on *Cissus "Syciacfolius."*

DISTRIBUTION: West Indies and Guatemala; also in South America.

48. *Accidium tuberculatum* Ellis & Kellerm. Jour. Myc. **4**:26. 1888.

On MALVACEAE:

Callirrhoe alcoides (Michx.) A. Gray, Colorado.

Callirrhoe involucrata (T. & G.) A. Gray, Kansas, Nebraska.

Sidalcea candida A. Gray, Wyoming.

TYPE LOCALITY: Rooks County, Kansas, on *Callirrhoe involucrata.*

DISTRIBUTION: West central Mississippi valley.

EXSICCATI: Carleton, Ured. Am. *31;* Kellerm. & Sw. Kans. Fungi *30;* Rab.-Paz. Fungi Eur. *1239;* Sydow, Ured. *1199.*

An especially characteristic species. Its telial connection is doubtless something other than a grass- or sedge-inhabiting rust.

49. *Aecidium* sp.

On MALVACEAE:

Althaea rosea L., Nebraska.

Sidalcea candida A. Gray, Colorado.

Sidalcea Neo-Mexicana A. Gray, Colorado.

DISTRIBUTION: Colorado and Nebraska.

A distinct species formerly confused with *Accidium interveniens* Pk. (*A. roestelioides* E. & E.) and *Aecidium tuberculatum* E. & K. Its thin-walled spores readily distinguish it from the former and the form of its aecia, which are circular in outline, distinguish it from the latter.

50. *Accidium interveniens* (Peck) Farl. Bibl. Index N. Am. Fungi **1**:58. 1905.

Roestelia interveniens Peck, Bull. Torr. Bot. Club **10**:74. 1883.

Accidium roestelioides E. & E. Jour. Myc. **1**:93. 1885.

On MALVACEAE:

Callirrhoe alceoides (Michx.) A. Gray, Nebraska.

Callirrhoe digitata Nutt., Texas.

Malvastrum marrubioides Dur. & Hilg., California.

Malvastrum Thurberi A. Gray, Lower California.

Sidalcea asprella Greene, California.

Sidalcea candida A. Gray, Washington.

Sidalcea delphinifolia (Nutt.) Greene, California.

Sidalcea humilis A. Gray, California.

Sidalcea malvaefolia (Moc. & Seese) A. Gray, California.

Sidalcea Neo-Mexicana A. Gray, Colorado.

Sidalcea rivularis, Washington.

TYPE LOCALITY: Lower California, on *Malvastrum Thurberi.*

DISTRIBUTION: Nebraska south to Texas, west to Lower California and Washington.

EXSICCATI: Barth. Fungi Columb. *2401, 3201;* Clements, Crypt. Form. Colo. *600.*

A strikingly characteristic species readily distinguishable by its very thick-walled spores and deeply lacerate peridium.

The names *Accidium roestelioides* E. & E. and *Aecidium interveniens* (Pk.) Farl. are here considered as synonyms. Type material has been examined and the two species are thought to be the same. The latter species name has priority, hence becomes the accepted species name.

51. *Accidium Sphaeralceae* E. & E. Bull. Torr. Bot. Club. 22:364. 1895.

On MALVACEAE:

Sidalcea candida A. Gray, Colorado.

Sphaeralcea angustifolia Den., New Mexico.

TYPE LOCALITY: Las Cruces, New Mexico, on *Sphaeralcea angustifolia.*

DISTRIBUTION: Colorado and New Mexico.

EXSICCATI: Ellis & Ev. N. Am. Fungi *3345;* Ellis & Ev. Fungi Columb. *871.*

There is no definite evidence that this form belongs with *Puccinia Sphaeralceae* E. & E., with which it sometimes occurs and with which it has been listed. It has the appearance of a heteroecious form and is so regarded here. Its telial form is likely to be a *Puccinia* on some grass. It may possibly belong with *Puccinia Dochmia* B. & C.

52. *Accidium Gossypii* E. & E. Eryth. 5:6. 1897.

On MALVACEAE:

Gossypium herbaceum L., Texas.

Gossypium sp., California, Lower California; Mexico.

TYPE LOCALITY: California, on *Gossypium* sp.

DISTRIBUTION: Texas to California, south to Mexico.

A rarely collected species. It may possibly belong with the aecia of *Puccinia Dochmia* B. & C.

53. *Accidium Cannoni* Griff. Bull. Torr. Bot. Club 34:210. 1907.

On FOUQUIERIACEAE:

Fouquiera splendens Engelm., Arizona.

TYPE LOCALITY: Sabino Cañon, Santa Catalina mountains, Arizona, on *Fouquiera splendens.*

DISTRIBUTION: Known only from type locality.

A characteristic species with long peridia.

54. *Accidium passifloricola* P. Henn. Hedwigia 43:168. 1904.

On PASSIFLORACEAE:

Passiflora rubra L., Jamaica, Porto Rico.

TYPE LOCALITY: Tarapoto, Peru, on *Passiflora* sp.

DISTRIBUTION: West Indies, also in South America.

55. *Accidium hydnoideum* B. & C. Grev. **3**:61. 1874.

On THYMELACEAE:

Dirca palustris L., Alabama, Indiana, Iowa, Maine, Michigan, Minnesota, Missouri, New York, Ohio, Wisconsin.

TYPE LOCALITY: Alabama, on *Dirca palustris*.

DISTRIBUTION: New York west to Minnesota, south to Alabama.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1816;* Rab.-Wint. Fungi Eur. *3017;* Ravenel, Fungi Car. **4**:*94;* Roum. Fungi Gall. *3862;* Thüm. Myc. Univ. *1126.*

There are no definite clues as to relationship for this characteristic, conspicuous *Accidium*. It is of the typical heteroecious type and may possibly belong with some heteroecious telial form, within its range, on a host other than a grass or sedge.

56. *Accidium Allenii* Clinton, Peck, Ann. Rep. N. Y. Mus. **24**:93. 1872.

On ELAEAGNACEAE:

Elaeagnus argentea Pursh, Montana, North Dakota; Assiniboia.

Lepargyraea argentata (Nutt.) Greene, Colorado, Nebraska, Wyoming.

Lepargyraea Canadensis (L.) Greene (*Shepherdia Canadensis* L.), Colorado, Michigan, Montana, New Mexico, New York, South Dakota, Washington, Wisconsin, Wyoming; Alberta, Yukon.

TYPE LOCALITY: Buffalo, New York, on *Shepherdia Canadensis*.

DISTRIBUTION: Northern United States, western Canada to Alaska.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1815;* Ellis & Ev. Fungi Columb. *1702;* Griff. W. Am. Fungi *297;* Rab.-Wint.-Paz. Fungi Eur. *1039,* Roum. Fungi sel. *1112.*

From field observations, Prof. E. W. D. Holway is reasonably certain that this *Accidium* belongs with a coronate *Puccinia* inhabiting *Agropyron* and *Elymus* in the Canadian Rockies. Later Mr. E. Bethel found the same coronate form on *Bromus* and *Calamagrostis* in the mountains of Colorado intimately associated with the same *Accidium*. From the geographical distribution of these alternate forms, this connection seems very likely.

57. *Accidium Nesaeae* Ger. Bull. Torr. Bot. Club **4**:47. 1873.

On LYTHRACEAE:

Decodon verticillatus (L.) Ell. (*Nesaea verticillata* H. B. K.). Delaware, Massachusetts, Michigan, New York, Ohio, Wisconsin.

TYPE LOCALITY: Poughkeepsie, New York, on *Nesaea verticillata*.

DISTRIBUTION: New York and Massachusetts, west to Michigan and Wisconsin.

EXSICCATI: Ellis, N. Am. Fungi *1015;* Ellis & Ev. Fungi Columb. *197;* Kellerm. Ohio Fungi *91;* Rab.-Wint. Fungi Eur. *3019*.

No telial form is known on this host. *Puccinia Nesaeae* E. & E. was described from material erroneously supposed to be on *Naesea verticillata*, but subsequently ascertained to be on *Ludwigia polycarpa*, belonging to the family *Onagraceae*. The form is probably heteroecious.

58. *Accidium Anograe* Arth. Bull. Torr. Bot. Club **28**:664. 1901.

On ONAGRACEAE:

Anogra pallida (Lindl.) Britton, Nebraska.

TYPE LOCALITY: Long Pine, Nebraska, on *Anogra pallida*.

DISTRIBUTION: Known only from Nebraska.

EXSICCATI: Barth. Fungi Columb. *2601*.

Distinguishable from *Accidium Peckii* DeT. which belongs with *Puccinia Peckii* (DeT.) Kellerm. by having larger and rougher spores.

59. *Accidium Proserpinaceae* B. & C. Grev. **3**:60. 1874.

On HALORAGIDACEAE:

Proserpinaca sp., Alabama.

TYPE LOCALITY: Alabama, on leaves of *Proserpinaca*.

DISTRIBUTION: Known only from type locality.

60. *Accidium Lysimachiae* Schw. Schr. Nat. Ges. Leipzig **1**:67. 1822.

On PRIMULACEAE:

Lysimachia quadrifolia L., Connecticut, New York, North Carolina.

Lysimachia terrestris (L.) B. S. P. (L. stricta A. Gr.), Connecticut, Delaware, North Carolina, Pennsylvania.

TYPE LOCALITY: Salem, North Carolina, on *Lysimachia quadrifolia*.

DISTRIBUTION: New York south to North Carolina.

EXSICCATI: Ellis, N. Am. Fungi *1424;* Ellis & Ev. N. Am. Fungi *1424b*.

Possibly belongs with some *Carex*-inhabiting *Puccinia*.

61. *Accidium leporinum* Arth. Bull. Torr. Bot. Club **37**:578. 1910.

On APOCYNACEAE:

Macrosiphonia brachysiphon (Torr.) A. Gray, Chihuahua.

TYPE LOCALITY: Guayanoba Cañon, Sierra Madre Mountaines, State of Chihuahua, Mexico, on *Macrosiphonia brachysiphon.*

DISTRIBUTION: Known only from type locality.

62. *Accidium Apocyni* Schw. Schr. Nat. Ges. Leipzig **1**:68. 1822.

On APOCYNACEAE:

Apocynum cannabinum L., District of Columbia.

Apocynum pubescens R. Br., Delaware, New Jersey, North Carolina.

TYPE LOCALITY: Salem, North Carolina, on *Apocynum cannabinum.*

DISTRIBUTION: New Jersey south to North Carolina.

EXSICCATI: Ellis & Ev. Fungi Columb. *1295.*

An eastern species characterized by its small spores.

63. *Accidium obesum* Arth. Bull. Torr. Bot. Club **37**:579. 1910.

On APOCYNACEAE:

Apocynum hypericifolium Ait., Illinois, Kansas, Nebraska.

TYPE LOCALITY: Manhattan, Kansas, on *Apocynum hypericifolium.*

DISTRIBUTION: Illinois west to Nebraska and Kansas.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1823;* Vestergren, Micr. Rar. Sel. *1101.*

A western species readily distingnishable from *Accidium Apocyni* Schw. by having much larger aeciospores.

64. *Accidium Brandegei* Peck, Bot. Gaz. **3**:34. 1878.

On ASCLEPIADACEAE:

Asclepias pumila (A. Gray) Vail, Kansas.

Asclepias subverticellata (A. Gray) Vail, New Mexico.

Asclepias verticellata L., Colorado, Nebraska, South Dakota.

Philibertella Hartwegii Vail, Chihuahua.

Philibertella Hartwegii hetcrophylla (Engelm.) Vail, Arizona.

TYPE LOCALITY: Colorado, on *Asclepias verticellata.*

DISTRIBUTION: Sonth Dakota to Kansas, west to New Mexico and Arizona, south into Mexico.

A striking species often causing considerable hypertrophy.

65. *Aecidium Hydrophylli* Peck, Bull. Buff. Soc. **1**:68. 1873.

On HYDROPHYLLACEAE:

Hydrophyllum albifrons Heller, Idaho.

Hydrophyllum canadense L., New York.

Hydrophyllum capitatum Dougl., Colorado, Idaho, Montana, Utah, Washington, Wyoming.

Hydrophyllum Fendleri (A. Gray) Heller, Colorado, Idaho, New Mexico, Wyoming.

Hydrophyllum occidentale A. Gray, California.

Hydrophyllum tenuipes Heller, Washington.

Hydrophyllum Virginicum L., Iowa, Minnesota, Nebraska, New York, Washington.

Hydrophyllum Watsonii (A. Gray) Rydb., Utah.

Macrocalyx Nyctelea (L.) Kuntze (*Ellisia Nyctelea* L.), Iowa, Kansas, Nebraska.

TYPE LOCALITY: Catskill Mountains, New York, on *Hydrophyllum canadense*.

DISTRIBUTION: New York, across the continent to Idaho and Washington, south to New Mexico.

EXSICCATI: Ellis & Ev. Fungi Columb. *2102;* Garrett, Fungi Utah. *35, 36;* Sydow, Ured. *154*.

A conspicuous species of wide range. Its telial connection is problematical. A large number of trial sowings on it have been made in cultures, but without success.

66. *Aecidium Phaceliae* Pk. Bull. Torr. Bot. Club **11**:50. 1884.

On HYDROPHYLLACEAE:

Phacelia alpina Rydb., Utah.

Phacelia heterophylla Pursh, Colorado, New Mexico, Utah; British Columbia.

Phacelia leucophylla Torr., Colorado.

Phacelia ramosissima Dougl., California.

Phacelia ramosissima hispida Gray, California.

Phacelia tanacetifolia Benth., California.

TYPE LOCALITY: Utah, on *Phacelia* sp.

DISTRIBUTION: British Columbia south to California, Colorado and New Mexico.

EXSICCATI: Barth. Fungi Columb. *3001;* Garrett, Fungi Utah. *31, 77;* Ellis & Ev. N. Am. Fungi *2218*.

A species of wide range in the Rocky Mountains and adjacent regions. Doubtless belongs with a telial form on some mountain grass.

67. *Accidium Guatemalensis* Kern & Kellerm. Jour. Myc. **13**:23. 1907.

On HELIOTROPIACEAE:

Helioptropium indicum L., Guatemala.

TYPE LOCALITY: Gualan, Department Zacapa, Guatemala, on *Heliotropium indicum*.

DISTRIBUTION: Known only from type locality.

68. *Accidium* sp.

On BORAGINACEAE:

Bourreria havanensis Miers, New Providence Island.

No doubt a new species.

69. *Accidium Myosotidis* Burr. Bot. Gaz. **9**:190. 1884.

On BORAGINACEAE:

Myosotis Virginica (L.) B. S. P. (*M. verna* Nutt.), Illinois, Missouri.

TYPE LOCALITY: Cobden, Illinois, on *Myosotis verna*.

DISTRIBUTION: Illinois and Missouri.

EXSICCATI: Ellis & Ev. N. Am. Fungi *1832*.

70. *Accidium Onosmodii* Arth. Bull. Torr. Bot. Club **31**:6. (Jan.) 1904.

Accidium Williamsi Ricker, Jour. Myc. **10**:165. (July) 1904.

On BORAGINACEAE:

Onosmodium Carolinianum (Lam.) A.DC., Kansas.

Onosmodium molle Michx., Kansas, Nebraska, North Dakota.

Onosmodium occidentale Mack., Colorado.

Lithospermum lincarifolium Goldie (*L. angustifolium* Michx.), North Dakota, South Dakota.

TYPE LOCALITY: Callaway, Nebraska, on *Onosmodium molle*.

DISTRIBUTION: From Kansas and eastern Colorado northward.

These two names are placed here as synonyms. The aecia can not be distinguished, the hosts are closely related, and their ranges coincide. It is therefore thought that they are one and the same species.

Morphologically the species is very similar to *Accidium Lithospermi* Thüm. and may possibly prove to be the same.

A rather likely connection for this *Aecidium* is the subepidermal leaf-inhabiting *Puccinia* of *Hordeum* or possibly *Puccinia triticina* Eriks. on *Triticum*.

71. *Aecidium Mertensiae* Arth. Bull. Torr. Bot. Club **31**:6. 1904.

On BORAGINACEAE:

Mertensia paniculata (Ait.) Don., Idaho.

Mertensia Sibirica (L.) Don., Oregon.

TYPE LOCALITY: Near Lolo Creek, Idaho, on *Mertensia paniculata*.

DISTRIBUTION: Idaho and Oregon.

In many ways this species is very similar to the preceding.

72. *Aecidium Physalidis* Burr. Bot. Gaz. **9**:190. 1884.

Aecidium Solani Am. Authors. Not. Mont.

On SOLONACEAE:

Physalis heterophylla Nees., Indiana, Nebraska.

Physalis lanceolata Michx., Colorado, Kansas, Nebraska.

Physalis longifolia Nutt., Nebraska.

Physalis Virginiana Mill., Colorado, Missouri.

Physalis viscosa L., Illinois, Texas.

TYPE LOCALITY: Urbana, Illinois, on *Physalis viscosa*.

DISTRIBUTION: Mississippi valley from Nebraska to Texas.

EXSICCATI: Ellis & Ev. N. Am. Fungi *3147, 2992;* Ellis & Ev. Fungi Columb. *1578.*

While it is considered by some that this *Aecidium* belongs with *Puccinia Physalidis* Peck, there is no definite proof to that effect either by cultures or otherwise. However, the fact that the two forms are largely co-regional and also that they resemble each other in general habit might be taken to reinforce the above supposition, but cultures are necessary to prove or disprove it definitely. No doubt the better way to make the culture is to sow fresh aeciospores on a sterile plant of their own host. The species is distinguishable from *Aecidium Solani* Mont. by its small aeciospores and its revolute and more coarsely lacerate peridium.

73. *Aecidium* sp.

On SOLONACEAE:

Chamaesaracha Coronopus (Dunal) A. Gray, New Mexico.

DISTRIBUTION: Known only from New Mexico.

Entirely distinct from the aecial stage of *Puccinia Chamaesarchae* Syd. which has a diffused mycelium while that of this is limited.

74. *Aecidium tubulosum* Pat. & Gaill. Bull. Soc. Myc. p. 97. 1888.

Aecidium Ulcanum Pazschke, Hedwigia **31**:91. 1892.

On SOLANACEAE:

Solanum Hartwegi Benth. (*S. torvum* Schlecht.), Cuba, Jamaica, Porto Rico, Mexico.

TYPE LOCALITY: Venezuela, on a spinose *Solanaceous* plant.

DISTRIBUTION: Mexico and West Indies.

75. *Accidium Chelonis* Ger. Bull. Torr. Bot. Club **5**:40. 1874.

On SCROPHULARIACEAE:

Chelone glabra L., Connecticut, Massachusetts, New York.

TYPE LOCALITY: Poughkeepsie, New York, on *Chelone glabra.*

DISTRIBUTION: New York, Massachusetts and Connecticut.

EXSICCATI: Ellis, N. Am. Fungi *1433;* Rab.-Wint. Fungi Eur. *3018;* Shear, N. Y. Fungi *322.*

76. *Accidium Palmeri* Ands. Jour. Myc. **6**:122. 1891.

On SCROPHULARIACEAE:

Pentstemon virgatus A. Gray, Arizona.

TYPE LOCALITY: Willow Spring, Arizona, on *Pentstemon virgatus.*

DISTRIBUTION: Known only from type locality.

Distinguishable from *Accidium Pentstemonis* Schw., which belongs with *Puccinia Andropogonis* Schw., by the relative thickness of the outer and inner walls of the peridial cells, and from the aecia of the autoecious *Puccinia Palmeri* D. & H. by the persistent and more cylindrical peridia, and the smaller spores. It is possibly connected with some western grass-inhabiting *Puccinia.*

77. *Accidium Collinsiae* Ell. & Ev. *Bull. Washb. Lab. **1**:4. 1884.
Accidium Tonellae D. & H. Erythea **3**:77. 1895.

On SCROPHULARIACEAE:

Collinsia parviflora Dougl., Washington.

Collinsia Rottani A. Gray, Washington.

Tonella tenella (Benth.) Heller, Washington.

TYPE LOCALITY: Falcon Valley, Washington, on *Collinsia parviflora.*

DISTRIBUTION: Known only from Washington.

Distinct from aecia of *Puccinia Collinsiae* P. Henn. which arise from a limited mycelium, that is, are in groups.

* Not verified from original description.

78. *Accidium Gerardiae* Peck, Ann. Rep. N. Y. Mus. **25**:92. 1873.

On SCROPHULARIACEAE:

Afzelia macrophylla (Nutt.) Kuntze, Nebraska.

Dasystoma flava (L.) Wood (*Gerardia flava* L.), Alabama.

Dasystoma virginica (L.) Britton (*Gerardia quercifolia* Pursh), Connecticut, Michigan, North Carolina, New Jersey.

TYPE LOCALITY: Near Cold Spring, New York, on *Gerardia quercifolia*.

DISTRIBUTION: Nebraska and Michigan, Connecticut south to Alabama.

EXSICCATI: Barth. Fungi Columb. *3302;* Ellis & Ev. N. A. F. *2710;* Roum. Fungi Sel. *4618;* Thüm. Myc. Univ. *1225;* Seym. & Earle, Econ. Fungi Suppl. *B30.*

This *Accidium* is very similar to the one on *Pentstemon*, which belongs with *Puccinia Andropogonis* Schw. and probably also belongs with this *Puccinia*. This supposition is strongly reinforced by a field observation made by Rev. J. M. Bates in 1910. After observing aecia in June on a plant of *Afzelia macrophylla*, he later found *Puccinia Andropogonis* developed close by. Since *Pentstemon*, *Dasystoma*, and *Afzelia* all belong to the same family, it is very likely that the similar aecia on them have the same telial connection, viz: *Puccinia Andropogonis* Schw.

79. *Accidium micropunctum* E. & E. Jour. Myc. **6**:119. 1891.

On SCROPHULARIACEAE:

Castilleja coccinea (L.) Spreng., Iowa.

Castilleja integrifolia Colorado.

Castilleja sessiliflora Pursh, Iowa, Nebraska, South Dakota.

TYPE LOCALITY: Pine Ridge, Nebraska, on *Castilleja* [*sessiliflora*].

DISTRIBUTION: Iowa, Nebraska and South Dakota.

From field observations in Nebraska, Rev. J. M. Bates suggests that this *Accidium* belongs with *Puccinia Ellisiana* Thuem. on *Andropogon*.

80. *Accidium* sp.

On SCROPHULARIACEAE:

Melampyrum lineare Lam. (*M. americanum* Michx.), Connecticut, Delaware, Massachusetts.

DISTRIBUTION: Southern New England States.

This *Accidium*, while similar to, is probably different from *Accidium Melampyri* Kuntze & Schum. of Europe which belongs with *Puccinia*

Moliniae Tul. on *Molinia coerulea*, especially since that rust is not yet recognized as American. The American *Accidium* probably belongs with some other grass-inhabiting *Puccinia*. It is doubtless a distinct species.

81. *Accidium Tracyanum* Syd. Hedwigia **40**:(129). 1901.

On ACANTHACEAE:

Colophanes oblongifolia (Michx.) Don. (*Ruellia oblongifolia* Michx.), Florida.

TYPE LOCALITY: Braidentown, Florida, on *Ruellia* [*oblongifolia*].

DISTRIBUTION: Known only from type locality.

Distinct from aecia of *Puccinia lateripes* B. & R.

82. *Accidium Oldenlandiaeum* Ellis & Tracy, Jour. Myc. **7**:43. 1891.

On RUBIACEAE:

Houstonia minor (Michx.) Britton, Alabama.

Houstonia purpurea L., Mississippi.

TYPE LOCALITY: Starkville, Mississippi, on "*Houstonia coerulea*," error for *H. purpurea* L.

DISTRIBUTION: Gulf States.

Distinct from *Accidium Houstoniatum* Schw. which belongs with *Uromyces* on *Sisyrinchium*, by aecia being produced from a limited mycelium.

83. *Accidium Bourardiae* D. & H. Bot. Gaz. **24**:36. 1897.

On RUBIACEAE:

Bourardia hirtella H. B. K., Guanajuato, Queritaro.

Bourardia triphylla Salib., Mexico.

Bourardia sp., Guanajuato.

TYPE LOCALITY: Rio Hondo, near City of Mexico, on *Bouvardia triphylla*.

DISTRIBUTION: States of Guanajuato, Queritaro, and Mexico.

Distinct from the aecia belonging to *Uromyces Bourardiae* Sydow.

84. *Accidium pulverulentum* Arth. Bull. Torr. Bot. Club **33**:521. 1906.

On RUBIACEAE:

Randia sp., Morelos, Jalisco.

TYPE LOCALITY: Cuernavaca, State of Morelos, Mexico, on *Randia* sp.

DISTRIBUTION: Morelos and Jalisco.

85. *Accidium Triostei* Arth. Bull. Torr. Bot. Club **33**:32. 1906.

On CAPRIFOLIACEAE:

Triosteum angustifolium L., Missouri.

TYPE LOCALITY: Perryville, Missouri, on *Triosteum angustifolium*.

DISTRIBUTION: Known only from Missouri.

86. *Accidium Valerianellae* Biv. Bernh. Stirp. Rar. Sicil. 1816.

On VALERIANACEAE:

Valerianella congesta Lindl., California, Washington.

TYPE LOCALITY: Sicily, on *Valerianella campanulata*.

DISTRIBUTION: Washington and California.

87. *Accidium Lygodesmiae* (Webber) Shear; Ellis & Ev. Fungi Columb. *1476*. 1901.

Accidium compositarum Lygodesmiae Webber, Bull. Neb. Agr. Exp. Sta. 1:n.9:61. 1889. Nomen nudem.

Accidium compositarum Lygodesmiae Webber, Rep. Neb. Bd. Agr. 1889: 210. (70). 1890.

On CICHORIACEAE:

Lygodesmia juncea (Pursh) D. Don., Montana, Nebraska, South Dakota.

TYPE LOCALITY: Belmont, Nebraska, on *Lygodesmia juncea*.

DISTRIBUTION: Nebraska, South Dakota and Montana.

EXSICCATI: Ellis & Ev. Fungi Columb. *1476*.

This is definitely a heteroecious form, as cultures by Dr. J. C. Arthur spring of 1911 show the telia on this same host to be autoecious. Possibly connected with some sedge-inhabiting *Puccinia* within its range.

88. *Accidium crepidicolum* E. & G. Jour. Myc. **6**:31. 1890.

On CICHORIACEAE:

Crepis acuminata Nutt., Montana.

Crepis glauca (Nutt.) T. & G., Utah.

Crepis runcinata (James) T. & G., Montana, Nebraska.

TYPE LOCALITY: Helena, Montana, on *Crepis acuminata*.

DISTRIBUTION: Nebraska, Montana and Utah.

Doubtless heteroecious and probably goes with some *Puccinia* on *Carex*.

89. *Accidium Hieraciatum* Schw. Trans. Am. Phil. Soc. II. **4**:293. 1832.

On CICHORIACEAE:

Hieracium Canadense Michx., Illinois, Minnesota.

Hieracium albiflorum Hook., British Columbia.

Hieracium cynoglossoides Arvet., Montana.

Hieracium paniculatum L., Pennsylvania.

TYPE LOCALITY: Bethlehem, Pennsylvania, on *Hieracium paniculatum*.

DISTRIBUTION: Pennsylvania west to Montana and British Columbia.

This Accidium is very similar to the one on *Lactuca* which belongs to what has been referred to the so-called *Puccinia Opizii* Bubak on *Carex*. Further, in 1907, Prof. E. W. D. Holway collected the *Accidium* at Glacier, B. C., and made the observation that it was possibly connected with a *Puccinia* on *Carex Deweyana* Schw. and C. *vitilis* Fries which *Puccinia* is practically indentical with the so-called *Puccinia Opizii* Bubak. This together with the fact that this *Hieracium Accidium* and *Puccinia Opizii* have practically the same general geographical distribution, makes it very likely that this *Accidium* belongs with the above named *Carex* rust, but cultures are necessary to prove this definitely.

90. *Accidium columbiense* Ellis & Ev. Erythea **1**:206. 1893.

On CICHORIACEAE:

Hieracium albiflorum Hook., Washington; British Columbia.

Hieracium Scouleri Hook., British Columbia.

TYPE LOCALITY: British Columbia, on *Hieracium* [*Scouleri*].

DISTRIBUTION: Washington and British Columbia.

Distinct from *Accidium Hieraciatum* Schw. in having a diffused mycelium.

Prof. Holway believes this to be connected with *Puccinia* on *Luzula*.

91. *Accidium* sp.

On AMBROSIACEAE:

Iva oraria Bartlett (*I. frutescens* A. Gray, not L.), Delaware, Florida, Louisiana, Virginia.

DISTRIBUTION: Salt marshes along the ocean and gulf coasts from Delaware to Louisiana. Evidently a heteroecious form.

92. *Aecidium Liatridis* (Webber) Ellis & Anders. Bot. Gaz. **16**:47. 1891.

Accidium compositarum Liatri Webber, Bull. Neb. Agr. Exp. Sta. **1**:n. **9**:60. 1889. Nomen nudem.

Aecidium compositarum Liatridis Webber, Rep. Neb. Bd. Agr. 1889:210 (70). 1890.

On CARDUACEAE:

Laciniaria punctata (Hook.) Kuntze (*Liatris punctata* Hook.), Montana, Nebraska, North Dakota.

Laciniaria spicata (L.) Kuntze (*Liatris spicata* (L.) Willd.), Nebraska.

Laciniaria scariosa (L.) Hill (*Liatris scariosa* Willd.), Kansas, Nebraska.

TYPE LOCALITY: Ansemo, Nebraska, on *Liatris scariosa.*

DISTRIBUTION: Kansas to North Dakota and Montana.

EXSICCATI: Barth. Fungi Columb. *2603,* *2902;* Brenckle, Fungi Dak. *101;* Carleton, Ured. Am. *38;* Sydow, Ured. *2317.*

Numerous trial sowings of teliospores on these hosts in cultures have been unsuccessful. The telial connection may possibly be some unrecognized *Puccinia* on some sedge.

93. *Aecidium Boltoniae* Arth. Bull. Torr. Bot. Club 28:664. 1901.

On CARDUACEAE:

Boltonia asteroides (L.) L'Her., Iowa, North Dakota, South Dakota.

TYPE LOCALITY: Spirit Lake, Iowa, on *Boltonia asteroides.*

DISTRIBUTION: Iowa to North Dakota.

With this as with the preceding species, numerous unsuccessful sowings have been made on the host in cultures. The telial connection is likely to be some sedge-inhabiting form.

94. *Aecidium Clibadii* Syd. Ann. Myc. 1:333. 1903.

On CARDUACEAE:

Clibadium arboreum F. D. Smith, Mexico.

Clibadium Donnell-Smithii Coult., Guatemala.

TYPE LOCALITY: Guatemala, on *Clibadium Donnell-Smithii.*

DISTRIBUTION: Known only from two localities.

95. *Aecidium Montanoae* D. & H. Bot. Gaz. 24:36. 1897.

On CARDUACEAE:

Montanoa sp., Mexico.

TYPE LOCALITY: Near City of Mexico, Mexico, on *Montanoa* sp.

DISTRIBUTION: Known only from type locality.

96. *Accidium Wedeliae* Earle, Mubl. 1:16. 1901.

On CARDUACEAE:

Wedelia carnosa Pers., Porto Rico.

TYPE LOCALITY: Mayaguez, Porto Rico, on *Wedelia carnosa.*

DISTRIBUTION: Known only from type locality.

97. *Accidium Bahiae* B. & C. Grev. 3:60. 1874.

On CARDUACEAE:

Bahia sp.

Eriophyllum stachadifolium Greene, California.

TYPE LOCALITY: (North America) on *Bahia* sp.

98. *Accidium Senecionis* Authors.

Accidium compositarum Senecionis Authors.

On CARDUACEAE:

Senecio aureus L., Iowa, New Hampshire, New York, Wisconsin.

DISTRIBUTION: New Hampshire west to Wisconsin and Iowa.

99. *Accidium* sp.

On CARDUACEAE:

Senecio praecox DC., Mexico.

DISTRIBUTION: Known only from State of Mexico.

A very characteristic form, no doubt a distinct species, doubtless belonging to some grass- or sedge-inhabiting telial form.

100. *Accidium Herrerianum* Arth. Bull. Torr. Bot. Club 33:520. 1906.

On CARDUACEAE:

Senecio salignus DC., Hidalgo.

TYPE LOCALITY: State of Hidalgo, Mexico, on *Senecio salignus.*

DISTRIBUTION: Known only from type locality.

A strikingly characteristic form, on account of its conspicuous peridium and large, thick-walled, dark colored spores. Doubtless heteroecious and possibly belongs with some telial form other than a grass- or sedge-inhabiting one.

101. *Accidium Compositarum* Authors.

(The following closely related forms, which have not been properly assigned to their telial connections and regarding which little is known,

are placed together under this one general "catch all" name, which has no particular significance. Field observations and cultures, along with further microscopical work, are necessary to segregate these forms. No doubt some of them will be found to belong with aecial forms already connected, while others of these forms will doubtless be found to have new heteroecious connections.)

On CARDUACEAE:

Colcosanthus grandiflorus (Hook.) Kuntze (*Brickellia grandiflora* Hook.), New Mexico.

Chrysogonum virginianum dentatum A. Gray, District of Columbia.

Chrysothamnus Parryi (A. Gray) Greene (*Aplopappus Parryi* A. Gray) New Mexico.

Dugaldia Hoopsii (A. Gray) Rydb. (*Helenium Hoopsii* A. Gray), Colorado.

Helenium autumnale L., Colorado.

Polymnia canadensis L., Iowa, Wisconsin.

Rudbeckia hirta L., Nebraska.

Rudbeckia laciniata L., Iowa, Nebraska, Wisconsin, Wyoming.

Rudbeckia triloba L., Delaware.

ACKNOWLEDGMENTS.

The writer wishes here to express his sincerest thanks to all who have assisted in any way in the pursuance of this study. The kindly attention and critical suggestions of Dr. J. C. Arthur, under whose direction the work has been done, has been greatly appreciated throughout. Acknowledgments are especially due Dr. Arthur for the free use of his exceptionally large private collection of plant rusts, as well as for free access to his extensive private library on this subject, without either of which this study would not have been possible at this time. Free use was also made of his private card indices and manuscript sheets on the subject, which very greatly facilitated the use of both the library and the herbarium, and where much information was already brought together in available form.

Sincere thanks are also extended to the other members of the botanical department of the Indiana Experiment Station, viz: to Dr. Frank D. Kern, Mr. C. R. Orton, Miss Evelyn Allison and Miss Mary A. Fitch, for kindly assistance in various ways.

INDEX OF SPECIES OF AECIDIUM.

* List number.

GENERIC INDEX OF HOSTS.

* Accidium number in list.

Purdue University,
Lafayette, Indiana.