

UREDINALES OF GUATEMALA BASED ON COLLECTIONS BY E. W. D. HOLWAY

II. AECIDIACEAE, EXCLUSIVE OF PUCCINIA AND FORM-GENERA

J. C. ARTHUR

The first portion of this account of the Guatemalan rust flora was issued in a previous number of this journal (June, 1918, pp. 325-336), and listed the twenty-two known species belonging to the families Coleosporiaceae and Uredinaceae. For convenience in indexing, the species are numbered consecutively with the previous part. The portion here submitted and the parts to follow will deal with the family Aecidiaceae (Pucciniaceae). The genera *Puccinosira*, *Endophyllum*, and the very similar *Endophylloides*, are usually placed with the Uredinaceae (Melampsoraceae), but it is believed that their affinities are better expressed in the present connection.

There are 79 species listed in this second portion, which fall into sixteen genera, all being small with one to three species each, except *Ravenelia* and *Uromyces* with twenty and thirty-five species respectively. The genus *Ravenelia* has its greatest development in the tropics, and the addition of five new species at this time indicates that many more new forms are yet awaiting discovery.

Probably the most interesting and striking new species of the eleven that are included in the paper is the one which introduces the genus *Skierka* to the flora of the western hemisphere. The whole morphological structure is unusual, and the long, flexuous filaments of agglutinated urediniospores, after the fashion of *Uredinopsis*, give to the specimen an astonishingly close resemblance, when seen with the naked eye or a hand lens, to the telia of *Cronartium*.

The species next in interest is *Dicheirinia binata*, for although the name was published sixty years ago the identity of the host has remained wholly conjectural until now, not even the family having been correctly suspected. It was originally collected in Nicaragua, a country adjacent to Guatemala. Recent collections were passing under the name *Uredo Cabreriana*.

Family: **Aecidiaceae (Pucciniaceae)**23. **RAVENELIA INGAE** (P. Henn.) Arth. (on Mimosaceae).

Inga edulis Mart., Chinautla, Dept. Guatemala, Feb. 12, 1916, II₂, 486; San Felipe, Dept. Retalhuleu, Jan. 14, 1917, 0, II₁, II₂, 719.

In studying the 1917 collection (no. 719), very large urediniospores were encountered, 37–55 μ long, which were longitudinally striate or rugose and also reticulated. There also occurred smaller, echinulate urediniospores, 18–23 μ long, corresponding to those described in the North American Flora (7: 133). Recently the writer erected a new species of *Inga* rust (*R. Whetzelii* Arth., Mycol. 9: 64. 1917), in which the urediniospores are echinulate-verrucose and longitudinally striate, and are 30–40 μ long. As there seemed to be mixtures of several forms on the Guatemalan collections, a careful re-examination of all material at hand was undertaken, the work being carried out by Dr. E. B. Mains.

It was soon noticed that in previous descriptions and discussions, although pycnia were observed, there had been no discrimination between primary and secondary uredinia. Upon studying the primary and secondary forms separately, it was found that the latter had quite uniformly small, echinulate spores, while the former had much larger spores, very variable in size and sculpturing. The primary form, accompanied by pycnia, causes slight or no hypertrophy, while the secondary form, unaccompanied by pycnia, produces considerable hypertrophy, especially in the young caulicular parts. The type material for *Uredo Ingae* P. Henn. consists of secondary uredinia, while that for *U. excipulata* Syd., *R. Ingae* Arth., and *R. Whetzelii* Arth., is largely primary in each case, all now believed to represent variations of one species. Twenty collections have been studied, including all the types, from which Dr. Mains has drawn up the following emended description:

Pycnia amphigenous, numerous in crowded groups 1–3 mm. across, depressed hemispherical, subcuticular, dark brown, 85–160 μ broad by 25–65 μ high.

Primary uredinia amphigenous, causing no or slight hypertrophy, circinating about the pycnia in areas 1–6 mm. in diameter, somewhat tardily naked, pulverulent, dark cinnamon-brown, subepidermal, ruptured epidermis conspicuous; urediniospores variable in size and shape, obovoid, clavate, or obovoid-fusiform, 15–26 by 23–55 μ , usually large, 32–40 μ long or sometimes very large, 37–55 μ long; wall golden-brown, 1.5–4 μ thick, thicker at apex, 3–10 μ , prominently

striate or rugose longitudinally with more or less evident reticulations, especially noticeable on the large spores, sometimes verrucose-striate above and nearly or quite smooth below, the pores 3 or 4, equatorial.

Secondary uredinia amphigenous and caulicolous, often covering and deforming the leaf stalks and young shoots, confluent on the leaves in irregular patches, 0.5–2.5 cm. across, early naked, highly pulverulent, cinnamon-brown, ruptured epidermis conspicuous; urediniospores broadly ellipsoid or obovoid, 13–19 by 18–26 μ ; wall golden-brown, 1.5–2 μ thick, thicker above, 3–5 μ , moderately or sparsely echinulate, the pores 3 or occasionally 4, equatorial.

Telia unknown.

24. *RAVENELIA ENTADAE* Lagerh. (on Mimosaceae).

Entada sp., Mazatenango, Dept. Suchitepequez, Feb. 22, 1916, II, 517.

The species has heretofore been known only from the type collection, made by Lagerheim in Panama.

25. *RAVENELIA SILIQUAE* Long (on Mimosaceae).

Vachellia Farnesiana (L.) W. & A. (*Acacia Farnesiana* Willd.), Laguna, Lake Amatitlan, Feb. 8, 1915, II, 199; Agua Caliente, Dept. Guatemala, Feb. 10, 1917, II, 850.

Neither primary uredinia nor telia have yet been discovered for this rust, although it is not uncommon throughout southern Mexico, Central America, and the West Indies.

26. *RAVENELIA LEUCAENAE-MICROPHYLLAE* Diet. (on Mimosaceae).

Acacia angustissima (Mill.) Kuntze (*A. filicina* Willd., *A. filiculoides* Trel.), Guatemala City, Jan. 1, 1915, ii, III, 9; Solola, 5100 feet alt., Jan. 27, 1915, ii, III, 138; Panajachel, Dept. Solola, Jan. 3, 1917, II, III, 674.

Two of these collections, nos. 138 and 674, were transmitted by Professor Holway with the host given as *Leucaena*, while another packet of no. 674 was transmitted later with the host given as *Acacia*, the determination being supplied by Mr. Paul C. Standley of the National Museum. No. 9 had the host named in 1915 by Mr. Standley as *Acacia filicina* Benth. Nos. 9 and 138 are accompanied by full-sized seed pods.

There appear to be no differences between this set of collections and the Holway collection of *Ravenelia Leucaenae-microphyllae* from Mexico. The foliage of all these collections is remarkably similar. The fruit has been seen for only two of them, nos. 9 and 138. It is

probable that the fragmentary collection which served as the type of the species is really an *Acacia* and not *Leucaena*. The type shows only a few imperfect urediniospores, while the present collections have well developed uredinia.

The uredinia are hypophyllous, on purple spots, round, 0.2–0.5 mm. across, early naked, somewhat pulverulent, cinnamon-brown, with the ruptured epidermis evident. The urediniospores are oblong or elongated ellipsoid, 13–16 by 26–35 μ , the wall cinnamon-brown, 1–1.5 μ thick and somewhat thicker above, about 3 μ , moderately echinulate, with 4 equatorial pores. The few spores heretofore seen did not show the thickening above, or the true form and size. The paraphyses intermixed with the spores are erect, clavate-capitate, 10–15 by 50–77 μ , with the wall chestnut-brown above and colorless below, and from 0.5 μ thick at the sides to 3–5 μ thick at the apex.

The species differs from *R. australis* Diet. & Neg., and from *Uredo Hieronymi* Speg., both on *Acacia Farnesiana*, in the paraphyses, and also in the urediniospores. Long¹ has recently found *R. australis* in Texas, and gives a detailed account of the species. The two species are similar in many respects, as noted in the North American Flora (7: 134), but the urediniospores of *R. Leucaenae-microphyllae* are more slender, and the paraphyses are erect and capitate, not at all incurved and hyphoid as in *R. australis*.

27. *RAVENELIA IGUALICA* Arth. (on Mimosaceae).

Acacia angustissima (Mill.) Kuntze (*A. filicina* Willd., *A. filiculoides* Trel.), Quezaltenango, Jan. 21, 1915, III, 97; Solola, 7000 feet alt., Jan. 25, 1915, II, III, 119.

The species has been taken heretofore but a few times between Texas and southern Mexico.

28. *Ravenelia inquirenda* Arthur & Holway sp. nov. (on Mimosaceae).

Acacia bursaria Schrenck, Laguna, Lake Amatitlan, Feb. 8, 1915, II, 196.

Uredinia amphigenous, scattered or somewhat grouped, roundish, 0.1–0.3 mm. across, somewhat tardily naked, subepidermal, opening by a slit or pore, pulverulent, cinnamon-brown, ruptured epidermis conspicuous; paraphyses intermixed with the spores, cylindric or clavate-capitate, 7–10 by 26–42 μ , the wall cinnamon-brown, uniformly about 0.6 μ thick; urediniospores ellipsoid or obovoid, 15–18 by

¹ Bot. Gaz. 64: 65. 1917.

23–29 μ ; wall cinnamon-brown, moderately thick, 1.5–2 μ , moderately echinulate, the pores 4, equatorial.

Telia unknown.

This rust appears to differ from all species so far described, and although without telia, requires to be independently named. Of the various *Acacia-Leucaena-Calliandra* rusts this is most like *R. gracilis* Arth., first reported from Mexico and recently found by Long in Texas (Bot. Gaz. 64: 66), but has smaller spores, with fewer pores.

29. ***Ravenelia distans*** Arthur & Holway sp. nov. (on Mimosaceae).

Genus and species undetermined, Retalhuleu, Feb. 26, 1916, ii, III, 535.

Urediniospores in the telia, lance-ovoid, 12–15 by 19–26 μ , usually acute above, somewhat narrowed below; wall cinnamon-brown, thin, 1 μ , much thicker above, 3–7 μ , moderately echinulate, the pores 4, equatorial.

Telia hypophyllous, scattered, round or oblong, 0.2–0.5 mm. across, early naked, subepidermal, chestnut-brown, ruptured epidermis evident; teliospore-heads chestnut-brown, 4–6 cells across, 55–75 μ in diameter, each spore with 6–8 semihyaline spines, about 3 μ long; cysts adnate to the lower side of the marginal cells.

This species has urediniospores of characteristic form. It is close to *R. Pazschkeana* Diet. on *Calliandra* from Brazil, but has smaller urediniospores and larger teliospore-heads composed of more spores. The leaves of the host have much the appearance of those of *Mimosa*.

30. ***Ravenelia bizonata*** Arthur & Holway sp. nov. (on Mimosaceae).

Calliandra Houstoni Benth., Guatemala City, March 16, 1916, II, iii, 584 (type).

Calliandra sp., Huehuetenango, Jan. 22, 1917, II, III, 762.

Uredinia epiphyllous, scattered or somewhat grouped, round or oval, 0.2–0.4 mm. across, early naked, subcuticular, pulverulent, dark chestnut-brown, ruptured cuticle inconspicuous; paraphyses intermixed with the spores, capitate or clavate-capitate, 15–19 by 23–48 μ , the wall golden brown above, colorless below, 1–1.5 μ thick, much thicker above, 7–10 μ ; urediniospores ellipsoid or obovoid, 15–19 by 20–26 μ ; wall dark cinnamon-brown above, paler below, thin, 1–1.5 μ , sometimes slightly thicker above, very finely and closely echinulate below, usually smooth at apex, the pores 6–8 in two zones, one equatorial, the other subequatorial.

Telia usually epiphyllous, scattered, round, 0.1–0.3 mm. across, soon naked, subcuticular, chestnut-brown, ruptured cuticle noticeable; teliospore-heads hemispherical, 4–6 cells across, 55–75 μ in diameter, each spore with 2–4 colorless tubercles, 3–10 μ long; cysts attached to the lower side of each marginal spore.

The species appears to be closest to *R. mexicana* Tranz., a Mexican rust on *Calliandra*, which is yet, unfortunately, imperfectly known. It is also like *R. versatilis* (Peck) Diet., on *Acacia Greggii*, in its structure, but probably has little relationship to it.

31. *RAVENELIA ECTYPA* Arth. & Holw. (on Mimosaceae).

Calliandra gracilis Klotzsch, Palin, Dept. Amatitlan, Dec. 24, 1916, II, III, 633.

Calliandra sp., Laguna, Lake Amatitlan, Feb. 8, 1915, ii, III, 204.

The species also occurs in Costa Rica on *C. gracilis*.

32. *Ravenelia sololensis* Arthur & Holway sp. nov. (on Mimosaceae).

Lysiloma acapulcensis Benth.(?), Solola, 7000 feet alt., Jan. 28, 1915, II, III, 147.

Uredinia amphigenous and fruticulous, scattered, round or elliptic, 0.2–0.5 mm. across, on the fruit up to 4 mm. long, early naked, subcuticular, pulverulent, dark chestnut-brown, ruptured cuticle conspicuous; paraphyses intermixed with the spores, clavate-capitate, 13–16 by 64–87 μ , the wall colorless below, chestnut-brown above, 0.5 μ thick below, 3–4 μ thick above; urediniospores ellipsoid or broadly obovoid, 16–19 by 27–35 μ ; wall light chestnut-brown above, paler below, 1.5 μ thick, sometimes a little thicker above, up to 3 μ , moderately echinulate, the pores 4, equatorial.

Telia amphigenous and fruticulous, scattered, round or elongated elliptic, 0.2–0.4 mm. across, on the fruit up to 6 mm. in length, early naked, subcuticular, dark chestnut-brown, ruptured cuticle conspicuous; teliospore-heads chestnut-brown, 7–9 cells across, 70–107 μ in diameter, each spore with 4–6 nearly colorless spines, about 3 μ long; cysts attached beneath the head.

The species differs noticeably from *R. Lysilomae* Arth. by having the teliospore-heads with spines instead of smooth, and in the differently shaped urediniospores. It has some resemblance to *R. Leucaenae* Long, but is abundantly distinct.

33. *RAVENELIA ACACIAE-PENNATULAE* Diet. (on Mimosaceae).

Acacia pennatula Benth., Panajachel, 5100 feet alt., Dept. Solola, Jan. 30, 1915, II, iii, 162.

Heretofore this species has been known only from collections made by Professor Holway in southern Mexico.

RAVENELIA MIMOSAE-ALBIDAE Diet. (on Mimosaceae).

34. *Mimosa albida* H.B.K., Solola, 5100 feet alt., Jan. 27, 1915, II, 137.

The species, chiefly known from Mexico, was collected by Keller-

man on *M. albida floribunda* Robins., between Antigua and Volcan de Agua, Feb. 18, 1905, II, 5360, and reported by Kern in *Mycologia*, l. c.

35. **Ravenelia Mainsiana** Arthur & Holway sp. nov. (on Mimosaceae).

Mimosa albida H.B.K., Guatemala City, Jan. 3, 1915, ii, III, 13.

Uredinia amphigenous, scattered, oval, 0.2–0.8 mm. long, early naked, pulverulent, cinnamon-brown, ruptured epidermis evident; paraphyses intermixed with the spores, clavate or capitate, 7–16 by 29–45 μ , the wall slightly tinted, uniformly thin, 0.5–1 μ , the stipe often solid; urediniospores ellipsoid or broadly obovoid, 16–18 by 18–23 μ ; wall cinnamon-brown, 1.5–2 μ , moderately echinulate, the pores rather indistinct, 8–10, scattered.

Telia amphigenous, scattered or in small groups, round or oval, 0.4–0.8 mm. across, subepidermal, soon naked, blackish, ruptured epidermis conspicuous; teliospore-heads irregular, flat, dark chestnut-brown, 3–6 cells across, 55–71 by 74–93 μ , each spore bearing 7–9 spines, up to 3 μ long; cysts pendent from base of pedicel, swelling and bursting in water.

This rust differs from *R. Mimosae-albidae* Diet. in well marked characters. The teliospore-heads are flat and irregular, not hemispherical and regular, the urediniospores are somewhat smaller and are echinulate not verrucose, while the paraphyses are smaller, lighter-colored, and thinner-walled than in the other species.

The host was determined by Mr. Paul C. Standley of the National Herbarium, who also determined the host for *R. Mimosae-albidae* (no. 137).

The species is named in honor of Dr. E. B. Mains, assistant botanist in the Indiana Experiment Station of Purdue University, who detected the specific distinctions and has drawn up the diagnosis. Dr. Mains has also done a large share of the microscopic work on the other species of *Ravenelia* listed in this paper, and also has given much aid in the critical study of some of the species of other genera, in all of which he has displayed excellent judgment and a fine sense of diagnostic values.

36. **RAVENELIA SPINULOSA** Diet. & Holw. (on Caesalpiniaceae).

Cassia biflora L., Solola, Jan. 27, 1915, II, iii, 134; San Lucas Toliman, Dept. Solola, Feb. 3, 1915, II, III, 182; Guatemala City, Feb. 14, 1917, II, iii, 867.

Cassia sp., San Rafael, Dept. Guatemala, Jan. 9, 1915, II, III, 44; El Rancho, Dept. Jalapa, Feb. 13, 1915, II, III, 209.

The paraphyses of this species are quite variable; often there are

more cylindrical ones in a sorus than capitate ones. The species was collected by Kellerman on *C. biflora*, at Gualan, Dept. Zacapa, Dec. 30, 1905, II, III, 5441, and reported by Kern in Journ. Myc. l. c., and issued in Sydow, Uredineen 2089, and in Kellerm. Fungi Sel. Guat. 9.

37. *RAVENELIA INCONSPICUA* Arth. (on *Caesalpinaceae*).

Caesalpinia exostemma Moc. & Sesse, Sanarate, Dept. Guatemala, Feb. 10, 1916, II, III, 476.

Heretofore only the type collection of this species has been known, which was obtained by Professor Holway in Mexico on a host identified only as "Caesalpinia or Cassia." The present collection agrees with the type in all respects except that the paraphyses have the walls thinner at the sides and thicker above.

From the present study of the two collections, it becomes evident that the following modifications should be made in the original description of the uredinia: urediniospores 13–16 μ in diameter, the wall 1.5–2 μ ; paraphyses thickened above, 3–9 μ .

38. *RAVENELIA HUMPHREYANA* P. Henn. (on *Caesalpinaceae*).

Poinciana pulcherrima L.

A collection made by Kellerman at Gualan, Dept. Zacapa, Dec. 27, 1905, II, III, 5427, and reported by Kern in Journ. Myc. l. c., and also issued in Kellerman's Fungi Selecti Guatemalensis 8, and in Sydow's Uredineen 2088. Apparently only one collection was made, although Kern reports the year as "1906," and on the label of Kellerman's exsiccati the number is given as "5727." It is a common rust of tropical America, wherever the host occurs.

39. *RAVENELIA SIMILIS* (Long) Arth. (on *Fabaceae*).

Brongniartia sp., San Felipe, Dept. Retalhuleu, Jan. 13, 1917, III, 706.

The host formed a small tree in hedgerows, as seen by Professor Holway, but was not in flower or fruit. The species has heretofore been known only from central Mexico.

40. *RAVENELIA INDIGOFERAE* Tranz. (on *Fabaceae*).

Indigofera mucronata Spreng., Solola, Jan. 27, 1915, II, iii, 122.

Indigofera suffruticosa Mill., Palin, Dept. Amatitlan, Dec. 24, 1916, II, 637.

Indigofera sp., Antigua, Dept. Sacatepequez, Dec. 27, 1916, II, III, 640; Panajachel, Dept. Solola, Jan. 3, 1917, II, III, 667.

A very common rust both of insular and continental America.

41. RAVENELIA LONCHOCARPI Lagerh. & Diet. (on Fabaceae).

Lonchocarpus sp., Mazatenango, Dept. Suchitepequez, Feb. 22, 1916, II, 511, 522.

Although no material has been available with which to compare, yet the very unusually shaped urediniospores leave little doubt that the species in hand is the one described by Lagerheim and Dietel from Brazil in 1894. The rust also occurs in Cuba on *L. latifolius* H.B.K., but is not known to have been found elsewhere since the original collection was made. The Guatemalan collections show bullate hypertrophies, 3-8 mm. across, but no pycnia could be detected on them.

42. RAVENELIA APPENDICULATA Lagerh. & Diet. (on Euphorbiaceae).

Phyllanthus acuminatus Vahl, San Felipe, Dept. Retalhuleu, Jan. 12, 1917, II, iii, 699.

Phyllanthus sp., Solola, Jan. 27, 1915, ii, III, 127; Guatemala City, Dec. 21, 1916, III, 616; Panajachel, Dept. Solola, Jan. 3, 1917, III, 671.

The collection no. 699 shows a more pulverulent appearance in the telia than usual, although the type collection has also something of this tendency toward fragile pedicels. The species also occurs in Mexico.

43. DICHEIRINIA BINATA (Berk.) Arth. (on Fabaceae).

Erythrina glauca Willd.

The type collection for *Uredo Cabreriana* Kern & Kellerm., now known to be a synonym of this rust, was made by Kellerman, at Livingston, Dept. Izabel, Jan. 18, 1905, 5465. The host was determined as *Buettneria lateralis*, and so reported by Kern in Journ. Myc. l. c., but when collections of the same rust from Porto Rico came to hand in 1913, the collection was resubmitted to Mr. John Donnell Smith, who had named it in the first place, and under date of May 1, 1913, he replied . . . "I now perceive that it should have been referred to *Erythrina glauca* Willd."

The teliospores were recently found by Mr. H. R. Rosen on a specimen in the Arthur herbarium collected in 1906 on *Erythrina glauca* at Paso Real (Prov. Pinar del Rio), Cuba, by Arbaca and

O'Donovan. They agree in every way with those of the scanty type material from Nicaragua, and show that they are not "one slightly higher on the pedicel than the other," as given in N. Am. Flora 7: 147, but that the two spores of each pair are borne side by side. It now seems probable that the host of the Nicaraguan collection is *E. glauca*, or at least a species of the genus with similarly thick, glaucous leaves. The rust also occurs on *E. umbrosa* H.B.K. in Trinidad, W. I., where it was collected by J. B. Rorer, Oct. 21, 1916.

44. *TRANZSCHELIA PUNCTATA* (Pers.) Arth. (on Amygdalaceae).

Prunus sp., San Rafael, Dept. Guatemala, Jan. 7, 1915, II, 28.

This long-cycle, heteroecious species was collected by Kellerman on *Amygdalus persica* L., at Antigua, Feb. 15, 1905, II, 5358, and reported by Kern in Journ. Myc. l. c., under the early name, *Puccinia Pruni-spinosae* Pers.

45. *PHRAGMOPYXIS DEGLUBENS* (Berk. & Curt.) Dietel (on Fabaceae).

Benthamantha cinerea (L.) Kuntze, Guatemala City, Dec. 20, 1916, II, iii, 607.

Only a meager amount of the fungus was found. It differs slightly from collections made in Mexico upon other species of the same host-genus by the teliospores possessing a short apiculus and a less gelatinous layer in the wall.

46. *UROPYXIS SANGUINEA* (Peck) Magn. (on Berberidaceae).

Mahonia pinnata (Lag.) Fedde.

A collection of this widespread, long-cycle rust, having pycnia, uredinia, and telia, was made by Kellerman at Volcan de Agua, Dept. Sacatépequez, Feb. 15, 1905, II, 4624, and reported by Kern in Journ. Myc. l. c.

47. *Uropyxis Crotalariae* Arth. sp. nov. (on Fabaceae).

Crotalaria sp.

Uredinia amphigenous, oblong or irregular, large, 0.5–1 mm. long, soon naked, pulverulent, cinnamon-brown, ruptured epidermis somewhat overarching and conspicuous; urediniospores ellipsoid or globoid, 18–26 by 23–30 μ ; wall golden-brown to light yellow, 2–2.5 μ thick, moderately echinulate, the pores 6–8, scattered.

Telia chiefly epiphyllous, like the uredinia but smaller, 0.1–0.2 mm. across; teliospores globoid, 26–30 μ in diameter, the septum wanting; wall hygroscopic, the inner, firm portion dark chestnut-brown, 2–2.5 μ thick, the outer gelatinous layer yellow, swelling to 5–6.5 μ thick, the colorless cuticle sparsely verrucose; pedicel short, colorless, largely evanescent.

The collection selected for the type of the species was collected on an undetermined species of *Crotalaria*, by W. A. Kellerman, at Laguna, altitude 4000 feet, on Lake Amatitlan, Dept. Amatitlan, Jan. 17, 1906, II, iii, 5397. Another collection by Kellerman, showing only uredinia, was collected on *C. maypurensis* H.B.K., a cultivated plant called by the natives "Chipilin," at Guanda Viejo near Guatemala City, Feb. 3, 1905.

This is the first species of *Uropyxis* with one-celled teliospores yet recorded.

48. *UROPYXIS DALEAE* (Diet. & Holw.) Magn. (on Fabaceae).

Parosela diffusa (Moric.) Rose, Palin, Dept. Amatitlan, Dec. 24, 1916, ii, III, 638.

Parosela domingensis (DC.) Millsp. (*Dalea domingensis* DC.), Guatemala City, Jan. 8, 1917, II, 681.

Parosela nutans (Cav.) Rose, Guatemala City, Dec. 21, 1916, ii, III, 612.

An abundant species in Mexico, where it has been collected by Professor Holway and others, but is now first reported elsewhere.

49. *CALLIOSPORA DIPHYSAE* Arth. (on Fabaceae).

Diphysa robinoides Benth., Guatemala City, 5000 feet alt., Jan. 1, 1915, o, III, 8; Solola, Jan. 27, 1915, o, III, 121a; Panajachel, 5100 feet alt., Dept. Solola, Jan. 30, 1915, o, III, 157; Mazatenango, Dept. Suchitepequez, Feb. 22, 1916, o, III, 521; San Felipe, Dept. Retalhuleu, Jan. 14, 1917, o, III, 716.

Diphysa sp. (probably *D. robinoides* Benth.), between San Lucas Toliman and Patalul, Feb. 4, 1915, o, III, 191; Patulul, 6000 feet alt., Dept. Escuintla, Feb. 4, 1915, III, 195.

A short-cycle rust. In no. 191 most of the teliospores are much lighter-colored and thinner-walled than heretofore seen, giving at first sight the appearance of a distinct species. They are apparently not immature spores, but the early stage in the development of the sorus, in which these less resistant spores arise for a time to be replaced later by the usual dark-walled form, able to withstand greater variation in conditions. The lighter-colored form may be described as having inner walls cinnamon-brown, 1.5–3 μ thick, with the outer gelatinous layer swelling only 1–2 μ thick in water. These collections also show that many teliospores are smaller than given in the original description, which should have the lower limit of breadth placed at 23 μ , and of length 35 μ .

The species was also collected by Kellerman on *Diphysa* sp., at Palmar, Dept. Quezaltenango, Feb. 11, 1906, o, III, 5459, and reported by Kern in *Mycologia l. c.*

50. CALLIOSPORA HOLWAYI Arth. (on Fabaceae).

Eysenhardtia adenostylis Baill., Panajachel, Dept. Solola, Jan. 30, 1915, o, III, 161; same, Jan. 3, 1917, o, III, 666.

In both the collections here listed a small proportion of light-colored spores, corresponding to those described under *C. Diphysae*, are to be found. They have the inner wall cinnamon-brown, 1–1.5 μ thick, with the outer gelatinous layer scarcely swelling in water.

51. PROSPODIUM LIPPIAE (Speg.) Arth. (on Verbenaceae).

Lippia asperifolia Rich., Moran, Dept. Amatitlan, Dec. 22, 1917, ii, III, 617.

Lippia strigosa Turcz., Solola, 7500 feet alt., Jan. 28, 1915, II, III, 152; Quezaltenango, Jan. 16, 1917, ii, III, 730; Zunil, Dept. Quezaltenango, Jan. 28, 1917, II, III, 787.

Lippia umbellata Cav., Volcan de Agua, Dept. Sacatépequez, March 4, 1916, II, III, 554.

Lippia sp., Tecpan, Dept. Chimaltenango, Jan. 1, 1917, ii, III, 661.

A long-cycle rust, for which the pycnia and primary uredinia have not yet been recognized. It is often listed as *Puccinia Lippiae* Speg. It was collected by Kellerman on *Lippia myriocephala* Cham. & Schl., at Laguna, Lake Amatitlan, Jan. 20, 1906, ii, III, 5451 in part, and reported by Kern in *Mycologia l. c.*

52. PROSPODIUM TUBERCULATUM (Speg.) Arth. (on Verbenaceae).

Lantana sp., Huehuetenango, Jan. 22, 1917, ii, III, 767.

A long-cycle rust of both North and South America, for which the pycnia and primary uredinia are yet undescribed. It is frequently listed as *Puccinia tuberculata* Speg.

53. PROSPODIUM APPENDICULATUM (Wint.) Arth. (on Bignoniaceae).

Tecoma mollis H.B.K. (*Stenolobium molle* Seem.), Antigua, 5500 feet alt., Dept. Sacatépequez, Jan. 13, 1915, ii, III, 75.

Tecoma Stans (L.) Juss. (*Stenolobium Stans* D. Don), Sanarate, Dept. Guatemala, Feb. 10, 1916, o, II, 469; Palin, Dept. Amatitlan, Dec. 24, 1916, o, II, 639a.

Tecoma sp., on the pods, Sanejarate, between Barrios and Guatemala City, Feb. 12, 1915, II, 207; Panajachel, Dept. Solola, Jan. 3, 1917, ii, III, 664.

A long-cycle species, having pycnia, primary and secondary uredinia, and telia. It is often listed as *Puccinia appendiculata* Wint. Nos. 469 and 639a are the first collections in which pycnia and primary uredinia have been seen. The pycnia are amphigenous, and are crowded in small groups on discolored spots 1.5–3.5 mm. across. They are subcuticular, light chestnut-brown, broadly conical, 67–135 μ broad by 39–50 μ high. The primary uredinia are amphigenous, encircling the pycnia, round or somewhat oblong, 0.2–0.8 mm. across. The urediniospores are slightly larger, and with a more hygroscopic layer, than in the secondary form. Other characters for the two forms are the same in both.

54. *NEPHLYCTIS TRANSFORMANS* (Ellis & Everh.) Arth. (on Bignoniaceae).

Tecoma Stans (L.) Juss. (*Stenolobium Stans* D. Don), Sanarate, Dept. Guatemala, Feb. 10, 1916, 0, III, 467; Palin, Dept. Amatitlan, Dec. 24, 1916, 0, III, 639.

A short-cycle species, often listed as *Puccinia transformans* Ellis & Ev. No. 639 also showed a small amount of *Prospodium appendiculatum*, 0, II, on some of the leaves, and is recorded under that species as no. 639a.

55. *PHRAGMIDIUM OCCIDENTALE* Arth. (on Rosaceae).

Oreobatis trilobus (Seringe) Rydb., Quezaltenango, Jan. 31, 1917, ii, III, 813.

This collection agrees closely with the species as heretofore known on *Rubacer parviflorum* in the western United States and Canada, but the lower part of the telial pedicels are more highly hygroscopic, in water usually swelling until they burst.

56. *PHRAGMIDIUM SUBCORTICINUM* (Shrank) Wint. (on Rosaceae).

Rosa cult., Antigua, Dept. Sacatépequez, March 4, 1916, ii, III, 544; Malacatancito, Dept. Huehuetenango, Jan. 25, 1917, II, III, 778.

The species appears to be rare in Guatemala, although it is cosmopolitan on cultivated roses, especially on those having the general characteristics of *Rosa gallica*.

57. *PHRAGMIDIUM POTENTILLAE* (Pers.) P. Karst. (on Rosaceae).

Potentilla sp., Volcan de Agua, Dept. Sacatépequez, March 7, 1916, II, III, 572; same, Dec. 29, 1916, II, III, 657.

A cosmopolitan rust of temperate regions. This is the first record for Central America, where it is doubtless rare.

58. **Skierka Holwayi** Arth. sp. nov. (on Sapindaceae).

Thouinidium decandrum Radlk. (?), Sanarate, Dept. Guatemala, Feb. 10, 1916, ii, III, 475.

Thouinidium sp., Agua Caliente, Dept. Guatemala, Feb. 10, 1917, o, II, III, 849 (type).

Pycnia amphigenous, solitary or few in small groups, noticeable, reddish-brown, subepidermal, discoidal, 416–448 μ in diameter, 96–128 μ high; ostiolar filaments apparently wanting.

Uredinia chiefly epiphyllous, encircling the pycnia in groups 1–5 mm. across, round, 0.1–0.2 mm. in diameter, flask-shaped in cross section, covered by the greatly thickened epidermis, through which the dehiscence is by a small pore, the spores at first cohering in loose columns, soon falling apart and giving the spots a pulverulent, cinnamon-brown appearance; urediniospores oblong-fusiform or ellipsoid-fusiform, 19–26 by 43–60 μ when in alcohol or dry; wall golden-brown, 2.5–3 μ thick when dry or in alcohol, in water the outer, hygroscopic layer paler, swelling up to 7–10 μ , the apex beaked, 7–9 μ long in alcohol or dry, 10–15 μ long in water, very finely and inconspicuously verrucose when dry, appearing smooth when wet, the pores obscure, probably 2, equatorial.

Telia hypophyllous, opposite the uredinia and similar to them; teliospores oblong-fusiform, 12–19 by 35–50 μ exclusive of the acute or filiform beak, the narrowed base with a distinct hilum, cohering in long columns 4–5 mm. long, 80–150 μ in diameter; wall colorless, or slightly yellowish, the inner layer 1 μ thick, the outer layer not noticeable in alcohol or dry, swelling in water to 3–9 μ and disintegrating, with the apex filiform, up to 100 μ , and likewise disintegrating, the base deciduous from the slender, inconspicuous pedicel, leaving a noticeable hilum.

A very unusual rust, having the appearance of a *Cronartium*. The teliospores, however, are borne singly on pedicels from a flat hymenium, and breaking away are extruded in a long filament of agglutinated spores, held together by the mucilaginous outer layer of the spore wall. The genus was established by Raciborski for two species found in Java, the type species being on Burseraceae and the other on Euphorbiaceae. Another species was added by Hennings on Sapindaceae from the Congo region of Africa. In these three species the spores of both stages are smaller than in the American form, and the urediniospores have more of the customary appearance of those of rusts in general. In the present species the urediniospores are large, and have an outer hygro-

scopic layer. They are extruded from the mouth of the sorus and adhere in filaments to some extent, much as the teliospores do.

Were it not for the agglutinating action of the outer coat of the spores and the dropping away from the pedicel of the teliospores, after the fashion of urediniospores, this rust would doubtless be called a species of *Uromyces*. The decision reached by the Sydows (Monog. Ured. 3: 331) to place the genus *Skierka* under the Aecidiaceae (Pucciniaceae) appears to be well founded. The fortunate discovery of pycnia with the American material, thus completing the life cycle, adds to the understanding of its relationship.

The author takes special pleasure in commemorating the extensive and fruitful explorations by Professor Holway, and his untiring devotion to botanical science, by dedicating this unique species of rust to him.

59. *SPHENOSPORA PALLIDA* (Wint.) Diet. (on Smilaceae).

Smilax sp., San Felipe, Dept. Retalhuleu, Jan. 14, 1917, II, III, 718; Progreso, on the Puerto-Barrios-Guatemala City Ry., Feb. 12, 1917, II, III, 859.

This waxy-looking rust also occurs in Costa Rica and South America.

Both uredinia and telia are subepidermal. The manner of septation of the teliospore, by which the two cells are equally poised on the pedicel, and not to any extent superposed, appears to warrant the validity of the genus. The gross appearance of the waxy telia is very distinctive. Pycnia have not been seen, and the full life cycle is yet unknown. The germination of the teliospores appears to be apical.

60. *BAEODROMUS EUPATORII* Arth. (on Carduaceae).

Eupatorium Aschenbornianum Schauer, Chinautla, Dept. Guatemala, Feb. 12, 1916, 478, 484.

A short-cycle rust, heretofore known only from two collections made by Professor Holway in central Mexico.

61. *PUCCINIOSIRA PALLIDULA* (Speg.) Lagerh. (on Tiliaceae).

Triumfetta semitriloba L., Mazatenango, Dept. Suchitepequez, Feb. 21, 1916, 509.

A short-cycle rust, very common in tropical America. It was collected by Kellerman on *Triumfetta* sp., at Guatemala City, Feb. 3, 1905, 4608, and reported by Kern in Journ. Myc. l. c.

62. **Puccinosira Eupatorii** Lagerh. sp. nov. (on Carduaceae).

Eupatorium Aschenbornianum Schauer, Cerro Quemado, Dept. Quezaltenango, Jan. 21, 1915, 100; Zunil, Dept. Quezaltenango, Jan. 28, 1917, 0, III, 792.

Eupatorium sp., San Rafael, 7000 feet alt., Dept. Guatemala, Jan. 7, 1915, 16.

A specimen was distributed by G. von Lagerheim bearing the name here given. It was collected on *Eupatorium* sp., at Tichincha, Ecuador, June, 1892. The species appears not to have been published. The telia are hypophyllous, the teliospores angularly oblong, 15–20 by 42–60 μ , with nearly or quite colorless walls, 1.5–2 μ thick. Although the type material from South America does not appear to show pycnia, yet they are well developed on Professor Holway's no. 792. They are epiphyllous, honey-yellow, prominent, subepidermal, globoid, 90–112 μ in diameter, with ostiolar filaments present.

63. **PUCCINIOSIRA BRICKELLIAE** Diet. & Holw. (on Carduaceae).

Brickellia adenocarpa Robins., Solola, Jan. 29, 1915, 151; Guatemala City, Feb. 8, 1916, 466.

Brickellia adenocarpa glandulipes Robins., Quezaltenango, Jan. 20, 1915, 92; Huehuetenango, Jan. 21, 1917, 755; Zunil, Dept. Quezaltenango, Jan. 20, 1917, 783.

A short-cycle rust, heretofore known only from Mexico, and one collection by Kellerman on *B. Cavanillesii* Gray, from Volcan de Cerro Quemada, Feb. 8, 1906, 5448, and reported by Kern in Journ. Myc. l. c.

64. **ENDOPHYLLUM CIRCUMSCRIPTUM** (Schw.) Whetzel & Olive (on Vitaceae).

Cissus sp., Quirigua, Dept. Zacapa, March 22, 1916, 596; San Felipe, Dept. Retalhuleu, Jan. 12, 1917, 695; same, Jan. 14, 1917, 720.

This short-cycle rust was collected by Kellerman on *Cissus sicyoides* L., at Los Amates, Dept. Izabel, Jan. 17, 1905, 5335, and at Gualan, Dept. Zacapa, Dec. 28, 1905, 5440, and reported by Kern in Journ. Myc. l. c. It is rather common in the West Indies and South America.

65. **ENDOPHYLLUM DECOLORATUM** (Schw.) Whetzel & Olive (on Carduaceae).

Clibadium Donnell-Smithii Coult.

A collection of this short-cycle rust was seen in the cryptogamic

herbarium of the New York Botanical Garden, under the synonymous name *Aecidium Clibadii* Syd., made at Guatemala City, February, 1890, by J. Donnell Smith. The species is also known from Mexico, Porto Rico, and from South America.

66. ENDOPHYLLOIDES PORTORICENSIS Whetzel & Olive (on Carduaceae).

Mikania cordifolia (L.f.) Willd., Retalhuleu, Feb. 26, 1916, 538.

Mikania sp., Puerto Barrios, March 26, 1916, 603.

This short-cycle species appears to be most abundant in Porto Rico, but was found in the phanerogamic herbarium at the New York Botanical Garden, on *M. scandens* Willd., from Aspinwall, Panama, Hayes, 868, and on the same host from the vicinity of Secanquim, Dept. Alta Vera Paz, Guatemala, Jan. 11, 1905, Maxon and Hay, 3239.

67. UROMYCES CLIGNYI Pat. & Hariot (on Poaceae).

Andropogon hirtiflorus (Nees) Kunth (host det. by Hitchcock), San Rafael, Dept. Guatemala, 7000 feet alt., Jan. 10, 1915, II, III, 57; Solola, 7000 feet alt., Jan. 25, 1915, 1915, II, III, 114.

A rather abundant, heteroecious species in Mexico, also found in tropical Africa. Aecia are unknown.

68. UROMYCES LEPTODERMUS Sydow (on Poaceae).

Panicum barbinode Trin., Guatemala City, 4800 feet alt., Jan. 2, 1915, II, 12.

This common tropical rust was also collected by Kellerman, on *Panicum barbinode* Trin., at Laguna, Dept. Amatitlan, Feb. 5, 1905, II, 5364, and reported by Kern in *Mycologia l. c.*, and on *P. Liebmannianum* Trin., at Guatemala City, Feb. 2, 1905, II, 5376.

The species ranges from Florida into South America, being very common in the West Indies. It also occurs in India. The alternate stage is unknown.

69. UROMYCES ERAGROSTIDIS Tracy (on Poaceae).

Eragrostis limbata Fourn., Solola, 7000 feet alt., Jan. 31, 1915, II, III, 167; Antigua, Dept. Sacatépequez, Dec. 28, 1916, ii, III, 651.

The species is common in the southern United States and Mexico, and apparently local in the West Indies. The aecial stage is not known.

70. *UROMYCES EPICAMPUS* Diet. & Holw. (on Poaceae).

Epicampes macroura Benth., San Rafael, 7000 feet alt., Dept. Guatemala, Jan. 7, 1915, II, III, 26.

Known also from Mexico, but a rather rare species. The aecia are as yet unknown.

71. *UROMYCES COMMELINAE* (Speg.) Cooke (on Commelinaceae).

Tradescantia cumanensis Kunth, Guatemala City, Jan. 9, 1917, II, 683; San Felipe, Dept. Retalhuleu, Jan. 13, 1917, II, 710.

This imperfectly known rust rarely produces telia in the warmer regions of its range. This is the only record for its occurrence on *Tradescantia*, except the type collection from Argentina.

72. *Uromyces socius* Arth. & Holw. sp. nov. (on Loranthaceae).

Loranthus crassipes Oliver (?), Solola, 6000 feet alt., Feb. 1, 1915, I₂, III, 169; San Lucas Toliman, 5100 feet alt., Dept. Solola, Feb. 3, 1915, I₂, III, 185.

Loranthus sp., Antigua, Dept. Sacatépequez, March 1, 1916, II, III, 539; same, March 2, 1916, I₂, III, 545 (type); Panajachel, Dept. Solola, Jan. 3, 1917, III, 665.

Struthanthus densiflorus (Benth.) Mart., Huehuetenango, Jan. 22, 1917, ii, III, 765.

Aecia chiefly hypophyllous, crowded upon distended bladder-like areas 0.3–2 cm. across, short cylindric, 0.4–0.8 mm. in diameter, about 0.4 mm. high; peridium erect, erose; peridial cells rectangular or rhombic in side view, 23–26 by 35–45 μ , abutted or slightly overlapping, the outer wall 4–8 μ thick, transversely striate, smooth, the inner wall 7–10 μ thick, closely verrucose; aeciospores ellipsoid or oblong, 23–27 by 26–35 μ ; wall colorless, 2–3 μ thick, closely and finely verrucose.

Uredinia mostly hypophyllous, crowded in small circinating groups 1–4 mm. across, soon filled with teliospores, early naked, cinnamon-brown, pulverulent, ruptured epidermis evident; urediniospores fusiform or fusiform-ellipsoid, 16–26 by 37–55 μ ; wall golden-brown, 1.5–2.5 μ thick, moderately echinulate, the pores distinct, 4, equatorial.

Telia amphigenous, crowded in small circinating groups 1–4 mm. across, ellipsoid or oblong, 0.3–0.8 mm. long, compact, blackish, ruptured epidermis conspicuous; teliospores ellipsoid, obovoid or oblong-obovoid, 18–24 by 29–35 μ , rounded at both ends or somewhat narrowed below; wall dark chestnut-brown, 2–3 μ thick, thicker above, 5–9 μ , longitudinally verrucose-rugose in more or less broken lines 1–3 μ apart; pedicel colorless, as long as the spore, verrucosely roughened.

The uredinia of this species are sparingly formed, although urediniospores are abundant, being produced along with the teliospores. The aecia are unaccompanied by pycnia and seem to be secondary aecia. In these respects the species is like *U. ornatipes* Arth. on *Loranthus Sonorae*. In *U. circumscriptus* Neger and *U. Urbanianus* P. Henn., both on Loranthaceae from South America, no urediniospores have been recorded. This rust differs materially from *U. ornatipes* by absence of transverse wrinkling in the telial pedicels and by larger and differently shaped urediniospores. It differs from *U. circumscriptus* and *U. Urbanianus* by the rugose sculpturing of the teliospores in addition to the verrucose markings, as well as in the presence of uredinia.

73. UROMYCES IRESINES Lagerh. (on Amaranthaceae).

Iresine Celosia L. (*I. celosioides* L.), Solola, Jan. 28, 1915, I, III, 141; Aguas Amargas, Dept. Quezaltenango, Jan. 30, 1917, I, III, 803.

A description of this species was first published by Sydow in his Monog. Ured. 2: 227. 1910, from material collected by Lagerheim in Ecuador, on an undetermined Iresine, only teliospores being seen. Mention was made of its resemblance to a leptoform. The telia are very pale, almost colorless, and the spores germinate freely in the sorus. Ferdinandsen and Winge in their account of the fungi of the Virgin Islands, then the Danish West Indies (Bot. Tidskr. 29: 8. 1908), speak of "unripe" teliospores, in connection with *Puccinia macropoda* Speg. on *Iresine elatior*, which upon examination prove to be this species. The specimen came from the island of St. Thomas, and shows only telia.

The present material shows an especially fine development of the species. In both gatherings there are aecia, at first appearing in epiphyllous groups, which later become surrounded by telia on either or on both surfaces. Telia also occur independent of aecia. Where both forms occur together they are on pale spots, 2-6 mm. across, and are so unmistakably from the same mycelium that in spite of the leptoform of the telia they must be considered stages of one and the same species. No pycnia could be detected, even in the youngest stages of development. The aecia may be described as follows:

Aecia epiphyllous, gregarious on pale spots, 2-4 mm. across, round, about 0.2 mm. across, opening by a pore, in cross section definitely globoid, 190-220 μ in diameter, surrounded and overarched by the host tissue; peridium wanting; aeciospores irregularly ellipsoid,

18–21 by 25–31 μ ; wall pale or nearly colorless, thin, 1 μ , moderately verrucose with distinct, rather blunt warts.

74. UROMYCES CELOSIAE Diet. & Holw. (on Amaranthaceae).

Iresine Calea (Ib.) Standley (*I. latifolia* Benth. & Hook.), Antigua, 5300 feet alt., Dept. Sacat pequez, Jan. 10, 1915, II, III, 76; Solola, Jan. 27, 1915, II, III, 128.

The species was collected by Kellerman on *I. Calea*, at Guatemala City, Feb. 2, 1905, II, III, 4344, 5379; Laguna, Lake Amatitlan, Feb. 5, 1905, II, III, 5371, and Jan. 20, 1906, II, III, 5395; Antigua, Dept. Sacat pequez, Feb. 13, 1905, II, 5339; except nos. 4344 and 5395 these were reported by Kern in Journ. Myc. *l. c.* The host for all the Holway and Kellerman numbers here cited were redetermined, July 3, 1917, by Paul C. Standley, who recently monographed the genus for the North American Flora. Aecia have not yet been found.

75. UROMYCES APPENDICULATUS (Pers.) Fries (on Fabaceae).

Phaseolus atropurpureus DC., Laguna, Lake Amatitlan, Feb. 8, 1915, II, 202.

Phaseolus lunatus L., Panajachel, Dept. Solola, Jan. 30, 1915, II, III, 159.

Phaseolus sp., Antigua, Dept. Sacat pequez, Jan. 11, 1915, II, 67; Quezaltenango, Jan. 21, 1915, III, 105; Solola, Jan. 25, 1915, ii, III, 117; Moran, Dept. Amatitlan, Dec. 22, 1916, II, III, 620.

This common autoecious rust was also collected by Kellerman on *P. atropurpureus*, at Laguna, Feb. 5, 1905, II, III, 5372, and reported by Kern in Mycologia *l. c.* It is not a common species in warm regions.

76. UROMYCES FABAE (Pers.) DeB. (on Fabaceae).

Faba vulgaris L., Aguas Amargas, Dept. Quezaltenango, Jan. 30, 1917, II, 796.

A common autoecious species northward but rare in warmer regions.

77. UROMYCES PUNCTATUS Schr t. (on Fabaceae).

Astragalus guatemalensis Hemsl., Quezaltenango, Jan. 16, 1917, II, III, 736.

A common species in tropical regions. It is considered heteroecious, with aecia on Euphorbia. The aecia have not been found in America.

78. UROMYCES HEDYSARI-PANICULATI (Schw.) Farl. (on Fabaceae).
Meibomia angustifolia (H.B.K.) Kuntze, Guatemala City, March 17, 1916, II, III, 589.
Meibomia scorpiurus (L.) Kuntze, Mazatenango, Feb. 25, 1916, II, 528.
Meibomia tortuosa (Sw.) DC., Solola, Jan. 31, 1915, II, III, 163; Antigua, Dept. Sacatépequez, Dec. 28, 1916, II, III, 646.
Meibomia sp., Antigua, Dept. Sacatépequez, March 9, 1916, II, III, 583; Huehuetenango, Jan. 22, 1917, II, III, 761; same, II, 764.
The host of nos. 761 and 764 is a shrubby species. The rust is notable in possessing more strongly developed paraphyses than any collection before seen, being incurved and considerably thickened along the convex wall. The aecia of this long-cycle rust are rarely collected. Uredinia of the species were detected on *M. scorpiurus* in the herbarium of the New York Botanical Garden, on a phanerogamic specimen collected by Maxon and Hay, at Las Animas near Mazatenango, Feb. 16, 1905, 3450.
79. UROMYCES TRIFOLII (Hedw.f.) Lev. (on Fabaceae).
Trifolium amabile H.B.K., San Rafael, Dept. Guatemala, Jan. 9, 1915, II, III, 48.
A common autoecious species in temperate regions.
80. UROMYCES COLOGANIAE Arth. (on Fabaceae).
Cologania glabrior Rose, San Rafael, Dept. Guatemala, Jan. 7, 1915, II, 31; Guatemala City, Dec. 20, 1916, II, 609.
A long-cycle species, whose aecia are unknown. It occurs also in Mexico and Porto Rico.
81. UROMYCES GUATEMALENSIS Vestergr. (on Fabaceae).
Bauhinia inermis Pers., Patulul, 600 feet alt., Dept. Escuintla, Feb. 4, 1915, ii, III, 194.
A long-cycle rust, whose initial stage is unknown. It was first detected on a phanerogamic specimen collected by Bermoulli and Cario, on an undetermined species of *Bauhinia*, at Retalhuleu, March, 1876, 1311, and made the type of the species by Vestergren in Arkiv för Botanik.
82. UROMYCES MONTANUS Arth. (on Fabaceae).
Lupinus montanus H.B.K., Volcan de Agua, Dept. Sacatépequez, March 7, 1916, o, I, III, 576.

When this species was published in 1905 from Mexican material, it was considered that distinctly leptiform telia, with an abundant germination of teliospores taking place as rapidly as they matured, were incompatible with the association of grouped aecia accompanied by pycnia, such telia having always been considered short-cycled. The present collection shows the same intimate association of aecia and germinating telia, as also does a collection by Kellerman, Feb. 5, 1908, from the same region, on an undetermined *Lupinus*.

A similar association is also to be seen in *Uromyces elatus* Syd., from South America. In that species the telia are not dark brown, but very pale brown, the spores being almost colorless under the microscope. The teliospores of the South American species do not germinate so readily, but they are of the leptosporic form, having thin and delicate walls. No telia of either species have so far been found, except those with the aecia closely associated, although some collections of aecia of both sorts have been found without telia. Both species are high-altitude forms.

In view of the constant association of aecia and telia, both in this species and in *U. elatus*, it is now reluctantly admitted that there is strong likelihood of genetic connection. The aecia found with telia of *U. montanus*, and those of like characters but not so associated, are here placed under the name *U. montanus*. Such aecia have heretofore been placed with *U. Lupini* B. & C. Final decision must depend upon cultures.

It is found by further study with more abundant material, that the aecia of *U. Lupini* are somewhat smaller and thinner-walled than those of the other two species mentioned. The aecia of *U. montanus* and *U. elatus* have each a distinctive macroscopic appearance, the former being cupulate and in circinating groups, while the latter are cylindric (not so stated in the original description, as the type specimens were immature) and in small groups of a few sori each, giving the appearance of irregular distribution.

83. ***Uromyces illotus*** Arth. & Hol. sp. nov. (on Fabaceae).

Mucuna Andreana Micheli, Chinaulta, Dept. Guatemala, Feb. 12, 1916, II, iii, 487.

Uredinia hypophyllous, scattered, round or oval, 0.2–0.5 mm. across, early naked, pulverulent, dark cinnamon-brown, ruptured epidermis inconspicuous; urediniospores obovoid, 16–23 by 24–27 μ ; wall cinnamon-brown, moderately thick, 1.5 μ , moderately echinulate, the pores 3–4, equatorial or sometimes scattered.

Telia hypophyllous, scattered, round, 0.1–0.3 mm. across, early naked, compact, dark chocolate-brown, ruptured epidermis inconspicuous; teliospores obovoid or ellipsoid, 19–21 by 24–31 μ , rounded at both ends; wall dark chestnut-brown, thick, 2–2.5 μ , thicker above up to 5 μ , closely and finely verrucose; pedicel colorless, once to once and a half length of spore.

This rust differs from *Uromyces Mucunae* Rab. in its larger urediniospores and teliospores, and in the absence of uredinial paraphyses. Part of the original collection of *Uredo mucunicola* P. Henn. in the possession of the writer has yielded a few teliospores, which show it to be identical with *Uromyces Mucunae* Rab., for which it should be entered as a synonym.

84. UROMYCES INDIGOFERAE Diet. & Holw. (on Fabaceae).

Indigofera mucronata Spreng.

The species was collected by Kellerman, at Gualan, Dept. Zacapa, Dec. 28, 1905, II, 5444, and reported by Kern in Journ. Myc. l. c. The species is known from central Texas, southward through Mexico, but is not often collected.

85. UROMYCES PROEMINENS (DC.) Pass. (on Euphorbiaceae).

Chamaesyce brasiliensis (Lam.) Small (*Euphorbia brasiliensis* Lam.), Retalhuleu, Feb. 26, 1916, II, III, 533.

Chamaesyce hirta (L.) Millsp. (*Euphorbia hirta* L.), Solola, Jan. 28, 1915, I, ii, 142; Sanarate, Dept. Guatemala, Feb. 10, 1916, I, II, 477.

The species is a common long-cycle form. It was collected by Kellerman on *C. adenoptera* (Bertol) Small, at Los Amates, Dept. Izabel, Jan. 5, 1908, II, III, 7036, and on *C. lasiocarpa* (Klotsch) Arth., Laguna, Lake Amatitlan, Jan. 17, 1906, II, III, 5404, both reported by Kern in Mycologia l. c., and on *C. brasiliensis*, at Laguna, Lake Amatitlan, Feb. 8, 1905, II, III, 5341.

The species was also detected in the Field Museum, on a phanerogamic specimen of *Eumecanthus gramineus* (Jacq.) Millsp. (*Euphorbia graminea* Jacq.), sheet no. 247010, collected at Agua Caliente, June 2, 1909, by C. C. Deam, 6137. Only uredinia were present.

86. UROMYCES OAXACANUS Diet. & Holw. (on Euphorbiaceae).

Jatropha urens L., Guatemala City, Dec. 31, 1914, II, iii, 2.

A species heretofore known only from southern Mexico has not been found showing pycnia. It is doubtful if aecia occur.

87. UROMYCES GOUANIAE Kern (on Frangulaceae).

Gouania lupuloides (L.) Urban (*G. domingensis* L.).

Only the type collection of this species is known, which was obtained by Kellerman at Laguna, Lake Amatitlan, Jan. 25, 1906, II, III, 5391. It was described in *Mycologia* (3: 290. 1911).

88. UROMYCES HYPERICI-FRONDOSI (Schw.) Arth. (on Hypericaceae).

Hypericum pratense Schl. & Cham., San Rafael, Dept. Guatemala, Jan. 7, 1915, III, 25.

A long-cycle, autoecious rust, found in Mexico and northward, whose aecia are not uncommon in the cooler regions.

89. UROMYCES HOWEI Peck (on Asclepiadaceae).

Asclepias curassavica L., Laguna, Lake Amatitlan, Feb. 8, 1915, II, 203.

Asclepias guatemalensis Donn. Sm., San Rafael, 7000 feet alt., Dept. Guatemala, Jan. 7, 1915, II, III, 20.

A common rust in Canada and the United States east of the Rocky Mountains, and much less so in Mexico and the West Indies. The beginning stages of the life cycle are unknown.

90. UROMYCES CESTRI Mont. (on Solanaceae).

Cestrum aurantiacum Lindl., Solola, 7000 feet alt., Jan. 28, 1915, I, III, 143.

A South American rust, common in the West Indies where the aecia produce discoid galls or hypertrophy. It has not before been reported from the continent of North America.

91. UROMYCES MACULANS (Pat.) Arth. (on Solanaceae).

Cestrum lanatum Mart. & Gal., Chinautla, Dept. Guatemala, Feb. 12, 1916, I, 489.

The species also occurs in Costa Rica on *C. nocturnum* L. It is a long-cycle rust with aecia and telia, but no uredinia.

92. UROMYCES SOLANI Diet. & Holw. (on Solanaceae).

Solanum nudum H.B.K., Quezaltenango, Jan. 31, 1917, II, 815.

An imperfectly known rust, pycnia and aecia yet undiscovered, heretofore known from two localities in southern Mexico.

93. UROMYCES BOUVARDIAE Sydow (on Rubiaceae).

Bouvardia leiantha Benth., Guatemala City, Dec. 20, 1916, II, III, 605.

This collection tallies closely with the type collection of the species,

also from Guatemala, in size of spores and in having pedicels that are not inflated. Most collections from Mexico possess strongly inflated pedicels, with thicker walls to the urediniospores and teliospores, larger spores, and other correlated differences. There are, however, collections showing intermediate characters, as one from Chapala, Mex. (Barth. N. Am. Ured. 186), which also has pycnia and aecia present. Although the variation is considerable, yet there does not seem to be sufficient reason at present to consider the Mexican form distinct from the Guatemalan one.

The type collection was made by Heyde and Lux at Jumaytepeque, Dept. Santa Rosa (Ann. Myc. 1: 16. 1903), and on *Bouvardia leiantha*.

94. *UROMYCES HELLERIANUS* Arth. (on Cucurbitaceae).

Melothria scabra Naud., Guatemala City, Dec. 23, 1916, II, III, 630.

Melothria sp., Chinautla, Dept. Guatemala, Feb. 12, 1916, II, III, 483.

Genus and species undetermined, Mendez, Dept. Guatemala, Feb. 13, 1917, ii, III, 862.

The early stages of this long-cycle rust have not yet been discovered. The species was collected by Kellerman on *Cayaponia racemosa scaberrima* Cogn., at Moran, Dept. Amatitlan, February 1906, ii, III, 5436, and reported by Kern in Journ. Myc. l. c. The three collections here listed are the only ones known except from the West Indies.

95. *UROMYCES PRESSUS* Arth. & Holw. (on Carduaceae).

Vernonia Deppeana Less., San Lucas Toliman, 5100 feet alt., Dept. Solola, Feb. 2, 1915, II, 173; Malacatancito, Dept. Huehuetenango, Jan. 24, 1917, II, 779.

The life cycle includes pycnia, uredinia, and telia. The species also occurs in Costa Rica on the same host.

96. *UROMYCES POLYMNIAE* (P. Henn.) Diet. & Holw. (on Carduaceae).

Polymnia maculata Cav., San Rafael, Dept. Guatemala, Jan. 7, 1915, II, iii, 30; same, 7000 feet alt., Jan. 10, 1915, II, 62; Volcan de Agua, Dept. Sacatépequez, March 4, 1916, III, 553; Quezaltenango, Jan. 18, 1917, II, III, 749.

A long-cycle rust, having pycnia, aecia, uredinia, and telia, common in Mexico, and also occurring in South America.

97. *UROMYCES CUCULLATUS* Sydow (on Carduaceae).

Perymenium strigillosum (Rob. & Greenm.) Antigua, Dept. Sacaté-

pequez, March 1, 1916, ii, III, 541; Guatemala City, Jan. 7, 1917, II, III, 679.

Perymenium Purpusii Brandege, Quezaltenango, Jan. 16, 1916, II, III, 734.

Zexmenia scandens Hemsl., San Rafael, Dept. Guatemala, Jan. 9, 1915, ii, III, 43; San Lucas Toliman, Dept. Solola, Feb. 3, 1915, ii, III, 183; Panajachel, Dept. Solola, Jan. 3, 1917, II, III, 668.

A long-cycle species with aecia, very common in Mexico.

98. **Uromyces Salmeae** Arth. & Hol. sp. nov. (on Carduaceae).

Salmea scandens (L). DC., San Lucas Toliman, 7000 feet alt., Dept. Solola, Feb. 3, 1915, o, I, II, iii, 188.

Pycnia amphigenous, few in groups on discolored spots, subepidermal, noticeable, globoid or ellipsoid, 160–200 μ broad.

Aecia amphigenous, grouped, cupulate, 0.1–0.2 mm. in diameter; peridium delicate, short; peridial cells soon collapsing, thin-walled, 1 μ , coarsely and closely verrucose; aeciospores ellipsoid or oblong, 19–25 by 24–35 μ , wall light cinnamon-brown, 1.5–2 μ , usually thicker above, up to 5 μ , closely and coarsely verrucose.

Uredinia mostly hypophyllous, scattered, oval or oblong, 0.3–0.8 mm. long, early naked, pulverulent, ruptured epidermis evident; urediniospores obovoid or ellipsoid, 23–27 by 30–35 μ ; wall cinnamon-brown, 1–1.5 μ , moderately echinulate, the pores 2, slightly super-equatorial.

Telia hypophyllous, scattered, oval or oblong, 0.3–0.8 mm. long, early naked, somewhat pulverulent, light chestnut-brown, ruptured epidermis noticeable; teliospores oblong or narrowly ellipsoid, 18–23 by 35–50 μ , narrowed above and below; wall golden-brown above, lighter to colorless below, thin, 1 μ , much thickened above, 5–13 μ , smooth; pedicel colorless, fragile, as long as the spore.

99. **UROMYCES COLUMBIANUS** Mayor (on Carduaceae).

Melanthera aspera (Jacq.) Steud., Escuintla, Feb. 18, 1916, II, 507; Mazatenango, Feb. 22, 1916, II, 512; San Felipe, Dept. Retalhuleu, Jan. 13, 1917, o, I, II, iii, 711.

Melanthera oxylepis DC., Panajachel, Dept. Solola, Jan. 3, 1917, o, I, II, 672.

Melanthera sp., Quirigua, Dept. Zacapa, March 22, 1916, I, II, 602.

A long-cycle rust with all spore forms, common in Central America and the West Indies, as well as in South America.

100. UROMYCES BIDENTICOLA (P. Henn.) Arth. (on Carduaceae).

Bidens heterophylla Ort., Quezaltenango, Jan. 18, 1917, II, 747.

Bidens Holwayi Sherff & Blake, Quezaltenango, Jan. 31, 1917, 0, II₁, II₂, iii, 816.

Bidens pilosa L., San Rafael, Dept. Guatemala, Jan. 7, 1915, II, 27.

Bidens squarrosa H.B.K. (*B. tereticaulis* DC.), Guatemala City, Dec. 31, 1914, II, III, 4; Solola, 7000 feet alt., Jan. 25, 1915, II, III, 110; Zunil, Dept. Quezaltenango, Jan. 28, 1917, 0, II, 786.

A long-cycle rust, having pycnia, uredinia, and telia, common in the American tropics, especially in the uredinial stage. It has generally been listed as *U. Bidentis* Lagerh., a name that properly belongs to the similar short-cycle form. The rust in the uredinial stage was collected at Amatitlan, on *B. pilosa*, date not given, by Heyde and Lux, and on *B. leucantha* Willd., in January, 1876, place not given, by Bernoulli and Cario.

101. UROMYCES MONTANOAЕ Arth. & Holw. (on Carduaceae).

Montanoa hibiscifolia Benth., San Felipe, Dept. Retalhuleu, Jan. 13, 1917, II, 705.

Montanoa Pittieri Rob. & Greenm., Antigua, 5300 feet alt., Dept. Sacatépequez, Jan. 12, 1915, II, 77; San Lucas Toliman, 5100 feet alt., Dept. Solola, Feb. 2, 1915, II, III, 176; Moran, Dept. Amatitlan, Dec. 22, II, III, 625.

A rust similar to *Uromyces bidenticola*, but distinguishable in the urediniospores. As in that species, some of the telia show early germination in evident association with the uredinia. The genus *Montanoa* is somewhat but not closely related to *Bidens*.

PURDUE UNIVERSITY,
LAFAYETTE, INDIANA



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