ART. 44.—*The Uredinales, or Rust-fungi, of New Zealand: Part I—Pucciniaceae, Tribe Puccineae (containing Descriptions and Illustrations of Seventy-five Species).*

By G. H. CUNNINGHAM.

[*Read before the Wellington Philosophical Society, 27th October, 1921; received by Editor 31st December, 1921; issued separately, 8th June, 1923.*]

Plate 77.

OF the three classes into which the fungi are divided by systematists (if we exclude the *Fungi Imperfecti*) the third class, the *Basidiomycetes*, is characterized by the fact that the spores are borne at the apices of sterigmata which are in turn borne on basidia (see figs. 1, 2).

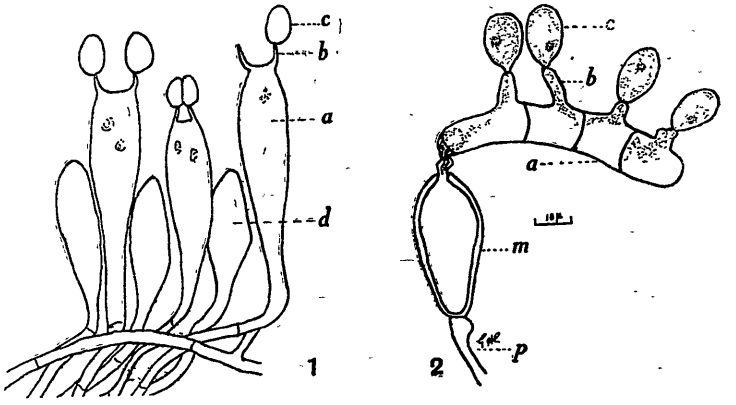

FIG. 1.—Basidia of *Agaricus arvensis*: *a*, basidium; *b*, sterigma; *c*, basidiospore; *d*, paraphysis. × 500.
FIG. 2.—Germinating mesospore of *Puccinia novae-zelandiae* n. sp.: *a*, basidium; *b*, sterigma; *c*, basidiospore; *m*, mesopore; *p*, pedicel. × 500.

In this class are included the Uredinales, for the reason that the teleutospores (or final spores produced in the cycle of development) on germination produce basidia,* which become divided into four cells by cross-septa, each segment producing a sterigma on which a basidiospore† is borne (see fig. 2, *c*).

BIOLOGY.

All rusts are parasitic during their entire life-cycle, which consists of one or more spore-forms, occurring on the same (autoecious) or on different (heteroecious) host plants. The cycle is a complex one, and includes as many as five spore-forms. As a rule all species are highly specialized, and each can infect but one host plant; exceptions occur, however—*e.g.*, *Puccinia Malvacearum* Bert., which attacks plants belonging to many different genera of the family Malvaceae.

* Basidium = promycelium. The former is the more suitable term.
† Basidiospore: In accordance with the classification this is the correct term to use. These spores are commonly termed "sporidia" or "sporidiola."

As an illustration of the life-history of a typical rust, the cycle of the heteroecious species *Puccinia Caricis* Schroet. is given below* :—

In the early spring the teleutospore germinates and produces basidia, one from each cell; these grow out through the germ-pores, and, as they develop, the contents of the cells pass into them. Each basidium becomes four-celled when mature, and from each segment a sterigma is produced, from the apex of which a basidiospore is cut off by abstriction. The basidiospores are readily detached, and are carried by wind or other agency to leaves and shoots of plants growing in the vicinity. Should a basidiospore chance to alight on a young leaf or shoot of *Urtica* it germinates and produces a short hypha, which penetrates the cuticle and enters the host-tissues, where it rapidly branches and forms a subcuticular mycelium, which soon gives rise to small flask-shaped bodies, the spermogones.† The body of the spermogone is embedded in the host-tissues, the neck alone protruding; this is formed of numerous hair-like paraphyses (fig. 3) arranged in such a manner that a small circular or elliptical opening (ostiolum) is formed, through which the spermatia pass. The body is lined with hyphal

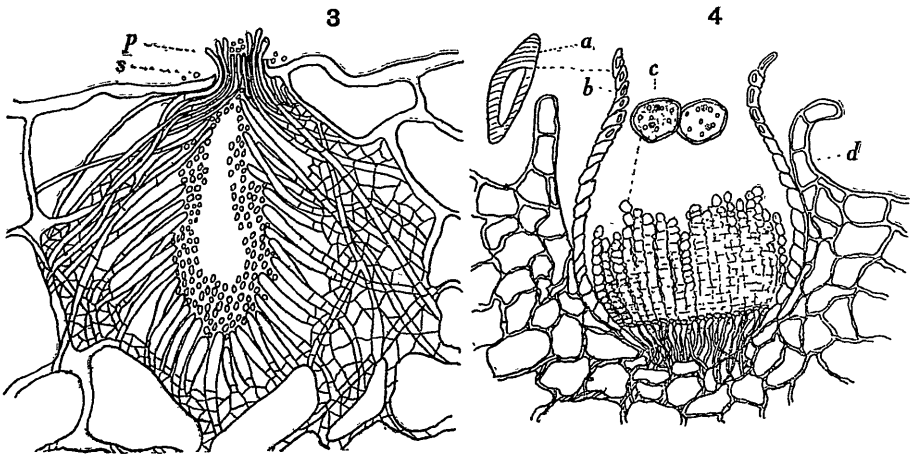

FIG. 3.—Spermogone of *Aecidium Ranunculorum*: *p*, paraphysis; *s*, spermatium. × 500.
FIG. 4.—Aecidium of *Puccinia tasmanica* Diet. from *Senecio lautus* Forst. f.: *a*, peridial cell; *b*, peridium; *c*, aecidiospore; *d*, host-tissues. × 250.

filaments, from the apices of which colourless elliptical spermatia are abstricted. The spermatia are embedded in a mucilaginous substance which is said to be somewhat sweet to the taste, and in certain species possesses a strong aromatic smell; doubtless these two features serve to attract insects, and so ensure dispersion of the spermatia. The mucilage is strongly hygroscopic, and in the presence of moisture swells and is forced through the ostiolum, carrying the spermatia with it on to the surface of the host, where it readily dissolves away and leaves the spermatia behind (see fig. 3, *s*).

As spermogones and spermatia are analogous to similar bodies found in the thallus of *Collema*, a genus of lichen, they were supposed to be male sexual organs, but as no corresponding female organ (trichogyne) has been

* This species is taken as a type because all spore stages are readily obtainable in New Zealand. This species was first suggested by W. B. Grove (1913) as a type in preference to *P. graminis*, as the aecidia are more easily obtained.

† Spermogones: Also known as "spermagonia," "pycnidia," or "pycnia."

observed in the Uredinales they were considerd to be functionless. Although they do not germinate when placed in water, Cornu showed that when placed in a weak sugar-solution the spermatia germinated readily, and produced a short hypha, which is but short-lived. The production of this hypha shows that, whatever the function of spermatia may be, it is not a sexual one; moreover, all experiments made with a view to ascertaining whether they will infect the host plant (and thus behave like conidia) have proved fruitless.

Shortly after the production of spermogones aecidia make their appearance. A typical aecidium consists of an outer peridium enclosing the central mass of aecidiospores (fig. 4). The peridium is at first globose and deeply immersed in the host-tissues, but owing to the gradually increasing pressure of the developing aecidiospores it becomes more or less cylindrical, until the apex reaches the surface, when it dehisces irregularly, the ruptured margins turning outwards until the peridium resembles a cup with widely-expanded margin. Sometimes dehiscence does not occur until the peridium extends some distance beyond the leaf-surface (Plate 77, fig. 1). The peridium is formed of irregularly hexagonal cells, whose inner surfaces are usually strongly sculptured (text-fig. 4, *a*). The peridium encloses the aecidiospores; these are produced in acropetal succession from basidia seated on the floor of the peridium; they are catenulate, and in young aecidia each spore is separated from its neighbour by a small compressed intercalary cell which soon disappears, so that its presence is often difficult to prove. The mature spores are at the top of the peridium, and as they are displaced others are forced into their place by the pressure of the developing spores below. Each spore is, as a rule, polygonal, owing to the pressure to which it has been subjected whilst within the peridium, and consists of an epispore, which is usually colourless, finely verruculose, and perforated by numerous obscure germ-pores, and granular contents brightly coloured by an oil which serves as reserve food. Generally aecidiospores remain viable but a short time, though cases have been recorded where they have germinated after a period of two months. In many species the mycelium is perennial and produces aecidia season after season; the presence of a perennial mycelium is usually indicated by distortion and yellowing of the host plant (Plate 77, fig. 2). Aecidiospores may give rise to further generations of aecidia on the same host, or may produce the next spore-stage in the cycle.

Should an aecidiospore alight on the leaf of *Carex*, if conditions are favourable it germinates and produces a single germ-tube (rarely more), which grows out through one of the germ-pores. As the germ-tube develops, the spore-contents pass into it and take up a position in its extremity. The germ-tube grows over the leaf-surface until it comes to a stoma, through which it passes, and in the stomal cavity swells, forming a vesicle which acts as a holdfast; once inside the stomal cavity it branches repeatedly, the branches (hyphae) penetrating between the cells of the host. From each hypha small haustoria are given off; these penetrate into the mesophyll cells and absorb the food substances necessary for their continued existence. The hyphae continue to develop rapidly until hyphal masses (mycelium) are formed immediately beneath the epidermis of the host. From this mycelium vertical hyphae are given off, on the apices of which small rounded cells are formed; these cells divide into two, the upper cell forming the uredospore, the lower the pedicel on which the uredospore is borne. By the pressure of these developing spores the epidermis becomes forced

upwards until a small blister is formed; this soon ruptures and exposes the uredospores. The mass of uredospores and their pedicels, together with the accompanying paraphyses (when present) collectively form the uredosorus. Mature sori are invariably surrounded and partially covered by the ruptured epidermis (Plate 77, fig. 3). Each uredospore is, as a rule, elliptical or subglobose, and consists of a coloured, echinulate epispore (text-fig. 5, A, *c*), perforated with one or several germ-pores, and containing the colourless, granular, and oily cell-contents. In certain species a thicker-walled spore, capable of remaining viable for a much longer period, is produced; this is termed an amphispore. Uredospores may remain viable but a short time, or may be capable of germination after a period of several months. Doubtless many of the rusts introduced into New Zealand are perpetuated by these spores alone, as their aecidia are absent, and their teleutospores are, in consequence, presumably functionless. From the same uredosori successive generations of uredospores are produced throughout the season. Uredospores are lightly attached to their pedicels, and, being readily detached, are carried by wind to other plants in the vicinity, and, if the hosts are suitable, give rise to uredosori. It is by this stage that many of the rusts are so widely distributed in a single season. Later in the season, in response to some stimulus, the teleutospore, or final spore in the cycle, is produced. Teleutospores may arise in sori produced directly from uredospore infection, or may be produced in the sori which have during the earlier part of the season produced uredospores. Teleutosori are, as a rule, similar in appearance to uredosori, but may generally be distinguished by their darker colour. In the sori teleutospores are formed in a similar manner to uredospores, save that the upper cell, after the first division (during which the pedicel is formed), again divides, and thus the two-celled spore is formed. The teleutospore consists of a thick-walled, usually smooth, dark-coloured epispore which is covered externally by a thin chitinous cuticle, and contains granular colourless cell-contents (fig. 5, B). In each cell a single germ-pore is present, which in the upper cell is usually apical, and in the basal usually immediately below the septum. Frequently in the teleutosori a second kind of teleutospore occurs; this is similar to the normal spore save that it is unicellular (fig. 2). They are called mesospores, and are probably teleutospores in which the second cell-division has, during their development, been omitted; they germinate in a similar manner to the normal spores, thus showing that they are functional. In the species under discussion the teleutospores are capable of remaining viable for many years; as a rule, however, they germinate the following spring, and from each germ-pore produce a basidium on which the basidiospores are borne. These, if they alight on *Urtica*, give rise to spermogones and aecidia, and so the cycle recommences.

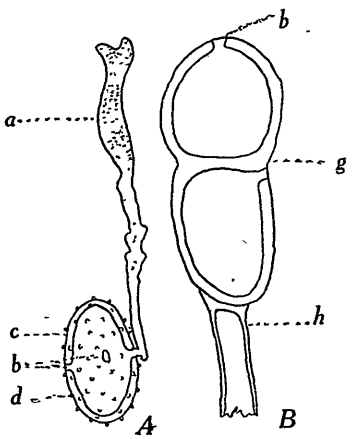

FIG. 5.—A. Germinating uredospore from *Anisotome aromatica* Hook. f.: *a*, germ-tube; *b*, germ-pores; *c*, epispore; *d*, sculpturing. × 500. B. Teleutospore of *Puccinia novae-zelandiae* n. sp.: *b*, germ-pore; *g*, septum; *h*, pedicel. × 325.

Variations from the above-described cycle occur in the different families and genera; these are more conveniently discussed under the generic descriptions, the above serving merely to convey some idea as to the different spore-forms commonly met with, and their relationships one with the other. For variations in the full cycle see the discussion under the genus *Puccinia*.

CYTOLOGY.

Space forbids more than brief mention of this subject here; fuller information may be obtained from the papers of Blackman (1904), Christman (1905, 1907), Olive (1908), &c.

Prior to the formation of aecidia, or primary uredosori (if the aecidia are absent), the hyphae beneath the epidermis first cut off a sterile cell from their apices; this undergoes no further development. The hyphal cell below this increases in size; it is at first uninucleate, but shortly becomes binucleate by the passage of a nucleus into it from an adjoining hyphal cell. The two nuclei do not fuse, but remain in the fusion cell, and, when this divides, both nuclei divide mitotically, but remain distinct from one another. This binucleate condition persists until teleutospore-formation, so that both aecidiospores and urediospores are binucleate. When a teleutospore is first formed both cells (*Puccinia*) are binucleate, but when the spore is nearly mature the nuclei fuse and each cell of the spore is then uninucleate. Consequently, when the teleutospore germinates, the resultant basidiospores, the mycelium to which they give rise, and the spermogones and their spermatia are all uninucleate.

DISTRIBUTION.

Of the 75 species discussed in this part, 46 are indigenous and the remainder are introduced. Of the 46 indigenous species, 23 are endemic, 19 occur in Australia, 15 in Tasmania, 4 in South America, and 6 extend to North America and Europe. The distribution may be illustrated better by the following table:—

Uromyces	
Microtidis ..	Aus.
puccinioides	Aus., Tas.
Thelymitrae	Aus.
Puccinia	
aucta ..	Aus.
Caricis ..	Aus., Tas., N.Am., Eur.
Cinerariae ..	Aus. "
Coprosmae ..	Aus., Tas.
Dichondrae	Aus., Tas., N. S. Am.
distincta ..	Aus., Tas.
Erechtitis ..	Aus., Tas.
Hederaceae	Aus., Tas.
Hydrocotyles	N.Am., Eur., S.Am.
Puccinia	
juncophila ..	Aus., Tas.
Lagenophorae	Aus., Tas.
Menthae ..	Aus., Eur., N.Am.
Morrisoni ..	Aus., Tas.
obscura ..	N.Am., Eur.
Plagianthi ..	Tas.
pulverulenta	Aus., Tas., N.Am., Eur., S.Am.
tasmanica ..	Aus., Tas.
Tetragoni ..	Aus., Tas.
Thuemeni ..	Aus., Tas.
Unciniarum	Chile.

In this paper (tribe Puccineae) 26 families are recorded as being attacked:—

Aizoaceae	1 P.	Goodeniaceae	1 U.	Polygonaceae	1 U., 2 P.
Campanulaceae	1 P.	Gramineae	2 U., 6 P.	Ranunculaceae	2 P.
Chenopodiaceae	1 U.	Halorrhagacëae	1 P.	Rhamnaceae	1 U.
Compositae	19 P.	Juncaceae	2 P.	Rosaceae	1 P., 1 G.
Convolvulaceae	1 P.	Labiatae	1 P.	Rubiaceae	1 P.
Cruciferae	2 P.	Leguminosae	5 U., 4 Ur.	Scrophulariaceae	1 P.
Cyperaceae	2 P.	Malvaceae	3 P.	Umbelliferae	5 P.
Gentianaceae	2 P.	Onagraceae	1 P.	Violaceae	1 P.
Geraniaceae	2 P.	Orchidaceae	2 U.		

(G. = *Gymnoconia*. P. = *Puccinia*. U. = *Uromyces*. Ur. = *Uromycladium*.)

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I have found the following books particularly useful: *British Rust Fungi* (W. B. Grove); *North American Flora* (*Uredinales*), vol. 7; (J. C. Arthur); *Rusts of Australia* (D. McAlpine); *Sylloge Fungorum* (P. A. Saccardo); and *Thesaurus* (Lindau and Sydow).

All drawings were made with a camera lucida from spores mounted in a 50-per-cent. solution of lactic acid in water. Surface sculpturings have been studied from material mounted dry. Drawings are all to the same scale (unless otherwise specified), and have all been reduced the same amount; they were originally magnified 1,000 diameters. All descriptions are original and are drawn up from material in the herbarium of the author.

CLASSIFICATION.

Only those families and genera that occur in New Zealand are considered here.

Uredinales.

Microscopic fungi which are obligate parasites on ferns and higher plants. Mycelium branched, filamentous, septate, developing within the host-tissues, intercellular, sending haustoria into the host-cells; producing teleutospores which are borne in sori below the surface, or rarely singly within the host-tissues. Sori naked, enclosed by peridia or paraphyses, or embedded in a thin stroma. Teleutospores on germination producing a short, four-celled basidium, on which basidiospores are borne.

The order may be divided into the three following families:—

A. Germination by the formation of an internal basidium of four superimposed cells:
Teleutospores in one or (rarely) two layers, forming waxy, bright-coloured crusts; one-celled, spores seated on dilated hyphal cells; aecidia with definite peridia; uredospores catenulate, or borne singly, not enclosed in peridia .. .. II. COLEOSPORIACEAE.

B. Germination by the formation of an external basidium:
a. Teleutospores not pedicellate, seated on dilated hyphal cells; compacted laterally into flat crusts, or more rarely produced singly within the host-tissues; one-celled, or divided longitudinally into 2–4 cells; epispore coloured or hyaline; uredosori and aecidia with or without peridia; uredospores borne singly on definite pedicels .. .. I. MELAMPSORACEAE.
b. Teleutospores pedicellate; borne singly on distinct pedicels, massed in pulvinate sori; one- or more-celled; epispore coloured or hyaline; aecidia with or without peridia; uredospores solitary on definite pedicels, without peridia .. .. .. III. PUCCINIACEAE.

In Part I the family Pucciniaceae, tribe Puccineae, is dealt with.

KEY TO GENERA OF THE PUCCINIACEAE.

a. Wall of teleutospore pedicel not or scarcely gelatinous..	Tribe PUCCINEAE.
(*a.*) Teleutospores one-celled; with one germ-pore in a cell:	
Pedicel unbranched at or near the apex, spore solitary on pedicel	1. *Uromyces.*
Pedicel branched near apex, bearing one or more spores, with or without hyaline vesicle	2. *Uromycladium.*
(*b.*) Teleutospores two-celled; with one germ-pore in each cell:	
Aecidia with peridia	3. *Puccinia.*
Aecidia without peridia	4. *Gymnoconia.*
b. Wall of pedicel subgelatinous	Tribe PHRAGMIDEAE.
Teleutospores two- or more-celled by cross-septa; with one or more germ-pores in each cell.	
Teleutospores in pulvinate, dark-coloured sori..	5. *Phragmidium.*
Teleutospores in yellow fibrils	6. *Hamaspora.*

Tribe PUCCINEAE.

1. UROMYCES Link.

Ges. Nat. Freunde Berlin Mag., vol. 7, p. 28, 1816.

Nigredo Rouss., *Fl. Calvados*, ed. 2, p. 47, 1806. *Caeomurus* S. F. Gray, *Nat. Arr. Brit. Pl.*, vol. 1, p. 541, 1821. *Pucciniola* Marchand, *Bijdr. Nat. Wet.*, vol. 4, p. 47, 1829. *Pileolaria* Cast., *Obs. Myc.*, vol. 1, p. 22, 1842. *Capitularia* Rab., *Bot. Zeit.*, vol. 9, p. 449, 1851. *Puccinella* Fcl., *Symb. Myc.*, p. 60, 1869. *Uromycopsis* Arth., *Result Sci. Congr. Bot. Vienne*, p. 345, 1906. *Klebahnia* Arth., *l.c.* *Spirechina* Arth., *Jour. Myc.*, vol. 13, p. 30, 1907. *Discospora* Arth., *N. Am. Fl.*, vol. 7, p. 149, 1907. *Teleutospora* Arth. & Bisby: Arth., *Bull. Torr. Cl.*, vol. 48, p. 38, 1921. *Haplotelium* Syd., *Ann. Myc.*, vol. 20, p. 124, 1922.

Autoecious or heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones flask-shaped, immersed, the surrounding paraphyses alone protruding, honey-coloured.

I. Aecidia at first immersed, becoming erumpent and cupulate, or cylindrical. Peridia hyaline, less frequently coloured, margins erect or revolute, dentate, lacerate, or seldom entire. Aecidiospores catenulate, commonly polygonal, less frequently elliptical; epispore usually verruculose, hyaline, seldom tinted, with numerous scattered and indistinct germ-pores.

II. Uredosori without peridia, commonly pulverulent, with or without paraphyses, and usually surrounded by the ruptured epidermis. Uredospores from globose to obovate, borne singly at the apices of pedicels; epispore commonly echinulate, less frequently verrucose, coloured, with one or several evident germ-pores which may be scattered or equatorially arranged.

III. Teleutosori compacted, less frequently pulverulent, naked or long covered. Teleutospores unicellular, borne singly on distinct pedicels; epispore smooth or variously sculptured, usually coloured, with one distinct apical germ-pore.

New Zealand species 13, of which 5 are indigenous, 2 being endemic, and the remainder introduced.

This genus is closely related to the genus *Puccinia* (*q.v.*), and is separated solely on account of the difference in the number of cells in the teleutospore.

In this paper the different species are arranged under their host families, the classification of Engler and Prantl in their *Natuerlichen Pflanzenfamilien* being followed. Where several species occur on different hosts belonging to the same family, they are arranged under that family in alphabetical order.

1. Uromyces Dactylidis Otth. (Fig. 6.) Gramineae (1).

Otth., *Mittheil. Nat. Gesell. Bern.*, p. 85, 1861.

**Aecidium Ranunculi-acris* Pers., *Obs. Myc.*, vol. 2, p. 22, 1795. *Aecidium Ranunculacearum* DC., *Fl. Fr.*, vol. 6, p. 97, 1815, *p.p. Uromyces graminum* Cke., *Handbk.*, p. 520, 1871.

0. Spermogones epiphyllous, honey-coloured.

I. Aecidia hypophyllous, and on petioles, seated on yellow spots, orange. Peridia cupulate, margins recurved, somewhat lacerate, white. Spores polygonal, 17–25 mmm.† diam.; epispore pale yellow, delicately verruculose.

II. Uredosori amphigenous, chiefly epiphyllous, scattered, or arranged in lines, up to 2 mm. long, pale brown, pulverulent, surrounded by the ruptured epidermis. Spores subglobose to obovate, 23–32 × 20–25 mmm.; epispore delicately and sparsely echinulate, 1·5–2 mmm. thick, golden-brown, cell-contents sulphur-yellow, with 3–5 scattered, usually papillate germ-pores on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, scattered, or arranged in lines, up to 2 mm. long, black, compact, bullate, long covered. Spores obovate, often pyriform, rarely elliptical, 20–27 × 15–19 mmm.; apex bluntly rounded, seldom acuminate, sometimes truncate, slightly (4 mmm.) or not thickened, darker in colour, base attenuate; epispore smooth, 1–1·5 mmm. thick, pale golden-brown, cell-contents vacuolate, nucleus prominent; pedicel persistent, tinted, up to 30 × 5 mmm.; germ-pore apical, obscure; paraphyses numerous, agglutinated into masses dividing the sori into compartments, chestnut-brown.

Host: *Dactylis glomerata* L. On leaves, sheaths, and culms. Herb. No. 288. II, III. Turakina; Kelburn (Wellington), *G. H. C.* Jan., 1921. II, III. Ettrick (Otago), *A. H. Cockayne!* 10 Feb., 1921. III. Tauranga (Auckland), *G. H. C.* 15 May, 1921.

Distribution: Europe.

The aecidia, which occur on *Ranunculus* spp., have not been collected in New Zealand. Opinions are divided as to the presence or absence of paraphyses in the teleutosori. In the New Zealand material they are abundant, and divide the sori into small compartments. They are somewhat swollen at their apices and tend to overarch the teleutospores, probably functioning as protective organs.

This species closely resembles *U. Poae* Rab., and by several authors is considered to be identical; others, again, separate them on both morphological (Grove, 1913, p. 128) and biological (Juel, 1908) grounds.

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* As most of the literature in which the earlier synonymy is published is not available in New Zealand, I have compiled the synonyms in this work from the publications of J. C. Arthur, F. Bubak, W. B. Grove, D. McAlpine, and P. A. Saccardo. Wherever necessary, dates and publications cited have been verified by reference to *Thesaurus* of Lindau and Sydow.

† In this article the contraction " mmm." is used for micromillimetres.

2. **Uromyces otakou** n. sp.* (Fig. 7.)

0, I. Unknown.

II. Uredosori epiphyllous, scattered, rarely linear, elliptical, up to 2 mm. long, bright orange-yellow, pulverulent, surrounded by the ruptured epidermis. Spores globose or subglobose, 20–30 mmm. diam.; epispore densely and minutely verrucose, 1–1·5 mmm. thick, hyaline, cell-contents orange, with 5–8 scattered germ-pores on one face.

III. Teleutosori epiphyllous, scattered, seldom confluent and forming lines, dark chestnut-brown, up to 3 mm. long, pulvinate, compact, surrounded by the ruptured epidermis. Spores obovate, 24–30 × 19–23 mmm; apex round, seldom bluntly acuminate, thickened up to 12 mmm., base subattenuate, frequently rounded; epispore smooth, 2–2·5 mmm. thick, chestnut-brown; pedicel persistent, tinted, up to 60 × 8 mmm; germ-pore apical, obscure.

Host: *Poa caespitosa* Spreng. On leaves and sheaths. Herb. No. 363. II, III. Routeburn Valley (Otago), 800 m., *W. D. Reid!* 6 May, 1921. (Type.) II. Cashmere Hills (Canterbury), 400 m., *W. D. Reid!* 31 July, 1921. Mount Judah (Otago), 800 m., *W. D. Reid!* 13 Dec., 1921.

The host is an indigenous species; it occurs also in Australia and Tasmania (Cheeseman, 1906, p. 907). The teleutospores are rare and difficult to find; they occur, as a rule, near the base of the sheath. The uredosori are plentiful, but in dried material difficult to find, owing to the fact that they are epiphyllous and are covered by the halves of the leaves folding together when drying. This species differs from *U. Dactylidis* in the greatly thickened apex of the teleutospore, different shape, and stouter pedicel. The uredospores closely resemble those of *Puccinia Poarum* Niels., but may be separated by the somewhat thicker and verrucose epispore; in *P. Poarum* the epispore is densely and sharply echinulate.

3. **Uromyces Microtidis** Cooke. (Fig. 8.) Orchidaceae (2).

Cke., *Grev.*, vol. 14, p. 12, 1885.

0. Spermogones amphigenous, associated with the aecidia, scattered, minute, erumpent, honey-coloured.

I. Aecidia amphigenous, scattered, minute, 100–150 mmm. diam., pale orange. Peridia cupulate, margins white, slightly expanded but not revolute, dentate. Spores polygonal, 15–20 × 12–16 mmm.; epispore hyaline, 1 mmm. thick, delicately and minutely verruculose, cell-contents orange, vacuolate.

II. Uredosori similar to and indistinguishable from the teleutosori. Spores elliptical to obovate, 20–30 × 17–23 mmm.; epispore sparsely and coarsely verruculose, tinted brown, 1–1·5 mmm. thick, with three equatorial germ-pores on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, elliptical, scattered, or aggregated into irregular groups, rarely confluent, bullate, up to 2 mm. long, pulverulent, long covered, finally becoming exposed by the epidermis rupturing longitudinally. Spores subglobose, elliptical, or frequently obovate, 25–35 × 20–26 mmm.; apex acuminate, often with a hyaline apiculus, thickened up to 8 mmm., base attenuate, frequently rounded; epispore coarsely warted or knobbed, 2·5–3 mmm. thick, chestnut-brown,

* Latin diagnoses of new species are arranged in alphabetical order in an appendix at the end of Part I.

cell-contents granular; pedicel decidous, hyaline, up to 50 × 10 mmm.; germ-pore apical, conspicuous.

Host: *Microtis porrifolia* R. Br. On leaves and sheaths. Herb. No. 331. II, III. Tiritea, Palmerston North (Wellington), *G. H. C.* 3 Mar., 1921. I, II, III. Hills near Petone (Wellington), *E. H. Atkinson!* 20 Dec., 1921.

Distribution: Australia.

The host is indigenous; it occurs also in Australia. The aecidia have not been recorded previously; they closely resemble those of *Uromyces Thelymitrae*. The latter species is distinguished by the larger, less warted, and less acuminate teleutospore.

4. Uromyces Thelymitrae McAlpine. (Fig. 9.)

McAlp., *Rusts Aus.*, p. 90, 1906.

0. Spermogones amphigenous, associated with the aecidia, scattered, minute, erumpent, honey-coloured.

I. Aecidia amphigenous, scattered, minute, 100–120 mmm. diam., orange. Peridia cupulate, margins pallid yellow, revolute, dentate. Spores polygonal, 17–22 mmm. diam.; epispore 1 mmm. thick, finely and densely verruculose, cell-contents orange-yellow.

II. Uredosori amphigenous, elliptical, scattered, or aggregated into irregular groups, seldom confluent, up to 2 mm. long, bullate, chocolate-brown, pulverulent, becoming exposed by the epidermis rupturing longitudinally. Spores subglobose, elliptical, or obovate, 25–30 × 16–21 mmm.; epispore 2 mmm. thick, closely and delicately echinulate, pallid yellow, cell-contents bright yellow, 3–4 equatorial germ-pores on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, scattered, or aggregated, seldom confluent, chocolate-brown, bullate, pulverulent, long covered, finally becoming exposed by the epidermis rupturing longitudinally. Spores elliptical, obovate, often polygonal, very irregular, 35–55 × 20–35 mmm.; apex bluntly acuminate, thickened up to 7 mmm., usually with a conspicuous hyaline apiculus, base attenuate; epispore 3–4 mmm. thick, irregularly knobbed or angled, chestnut-brown, cell-contents coarsely granular; pedicel decidous, hyaline, up to 60 × 12 mmm.; germ-pore apical, conspicuous.

FIG. 6.—*Uromyces Dactylidis* Otth. Uredo- and teleuto-spores from *Dactylis glomerata* L. *p* = paraphyses.

FIG. 7.—*Uromyces otakou* sp. nov. Teleutospores from *Poa caespitosa* Spreng.

FIG. 8.—*Uromyces Microtidis* Cke. Uredo- and teleuto-spores from *Microtis porrifolia* R. Br.

FIG. 9.—*Uromyces Thelymitrae* McAlp. Teleutospores from *Thelymitra longifolia* Forst. f.

FIG. 10.—*Uromyces Polygoni* Fcl. Uredo- and teleuto-spores from *Polygonum aviculare* L.

FIG. 11.—*Uromyces Betae* Lev. Uredo- and teleuto-spores from *Beta vulgaris* L.

FIG. 12.—*Uromyces Fabae* de Bary. Uredo- and teleuto-spores from *Vicia Faba* L.

FIG. 13.—*Uromyces striatus* Schroet. Uredo- and teleuto-spores from *Medicago sativa* L.

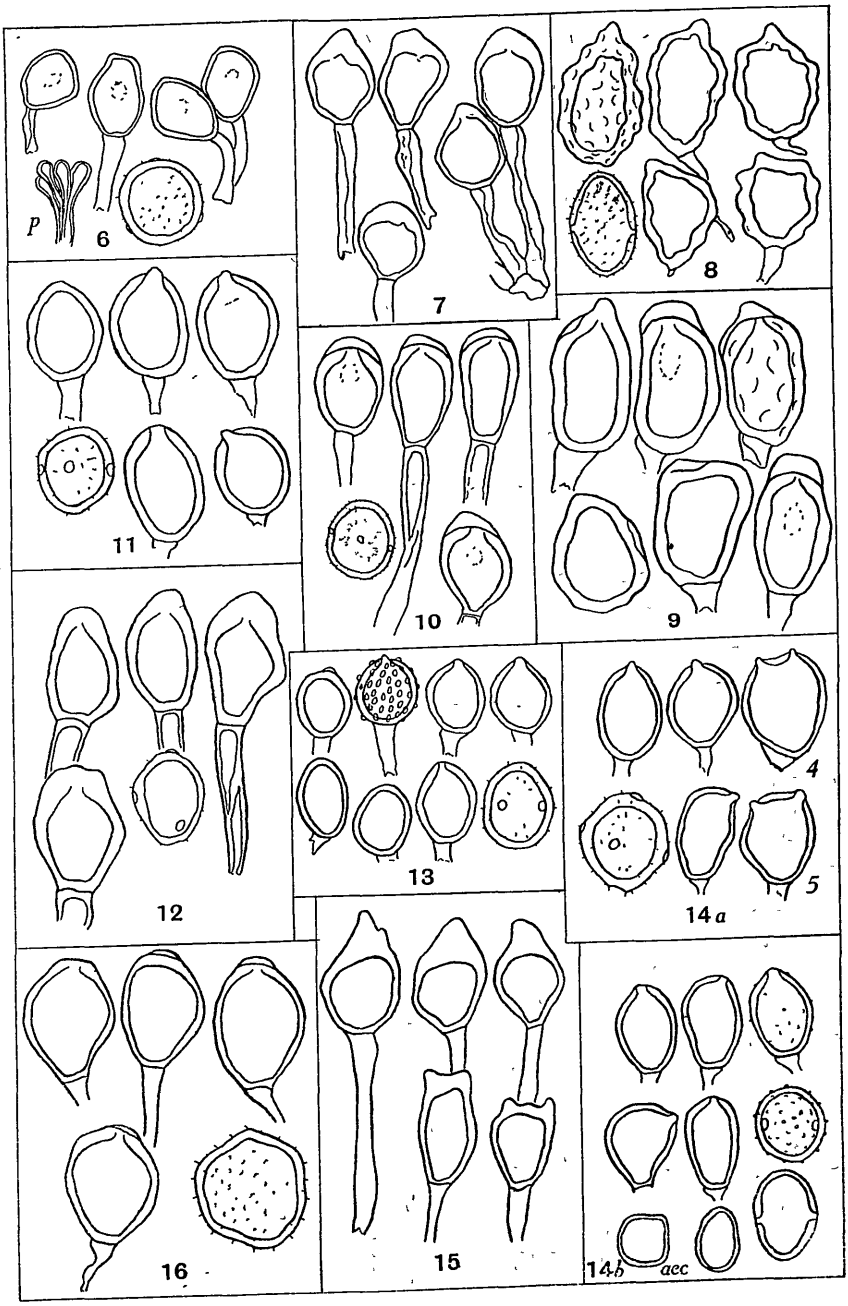
FIG. 14*a*.—*Uromyces Trifolii* Lev. Uredo- and teleuto-spores from *Trifolium pratense* L. Nos. 4 and 5 have two germ-pores.

FIG. 14*b*.—*Uromyces Trifolii-repentis* Liro. Aecidio-, uredo-, and teleuto-spores from *Trifolium hybridum* L. Aec. = aecidiospores.

FIG. 15.—*Uromyces Discariae* sp. nov. Teleutospores from *Discaria toumatou* Raoul.

FIG. 16.—*Uromyces puccinioides* Berk. et F. v. M. Uredo- and teleuto-spores from *Selliera radicans* Cav.

Camera-lucida drawings by author. All × 500.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Host: *Thelymitra longifolia* Forst. f. On leaves and sheaths. Herb. No. 319. I, II, III. Upper Hutt (Wellington), *Miss J. M. Anson!* 27th Nov., 1921. II, III. York Bay (Wellington), *E. H. Atkinson!* 13th Feb., 1921.

Distribution: Australia.

The host is indigenous and widespread; it occurs also in Australia and Tasmania (Cheeseman, 1906, p. 670). The aecidia, hitherto unrecorded, are abundant on the specimens forwarded by Miss Anson; they are remarkable for their minute size, and for the irregular manner in which they are scattered over the leaf. This rust differs from *U. Microtidis* in the larger and more coarsely knobbed teleutospores.

5. **Uromyces Polygoni** Fuckel. (Fig. 10.) Polygonaceae (3).

Fcl., *Symb. Myc.*, p. 64, 1869.

Puccinia Polygoni Pers., *Neues. Mag. Bot.*, vol. 1, p. 119, 1794. *P. Polygonii-Aviculare* Pers., *Syn. Fung.*, p. 227, 1801. *P. Aviculare* DC., *Fl. Fr.*, vol. 2, p. 221, 1805. *Dicaeoma Aviculare* S. F. Gray, *Nat. Arr. Brit. Pl.*, vol. 1, p. 542, 1821. *Uromyces Aviculare* Schroet., *Abh. Schles. Ges.*, vol. 68, p. 8, 1870. *Puccinia vaginalium* Link.: Cke., in *Handbk.*, p. 495, 1871. *Aecidium Aviculare* Kuntze: Cke., *l.c.*, p. 545. *Caeomurus Polygoni* Kuntze, *Rev. Gen.*, vol. 3, p. 450, 1898. *Nigredo Polygoni* (Pers.) Arth., *Res. Sci. Congr. Bot. Vienne*, p. 344, 1906.

0. Spermogones amphigenous, scattered, honey-coloured.

I. Aecidia amphigenous, chiefly hypophyllous, crowded on irregular discoloured spots. Peridia cupulate, margins hyaline, erect, dentate. Spores polygonal, frequently globose, 15–18 mmm. diam.; epispore densely and finely verruculose, 1 mmm. thick, hyaline, cell-contents pale yellow.

II. Uredosori amphigenous and caulicolous, scattered, circular, pulverulent, up to 1 mm. diam., surrounded by the ruptured epidermis. Spores broadly elliptical, obovate, or subglobose, 25–30 × 18–22 mmm.; epispore finely and densely verruculose, 1·5–2 mmm thick, golden-brown, with 4 equatorial germ-pores on one face.

III. Teleutosori amphigenous, more frequently caulicolous, on leaves scattered, on stems forming lines up to 10 mm. long, compact, pulvinate, chocolate-brown, soon naked. Spores elliptical, frequently obovate, sometimes pyriform, 25–40 × 16–25 mmm.; apex rounded, often bluntly acuminate, sometimes truncate, thickened up to 8 mmm., darker in colour, base attenuate; epispore smooth, 2–2·5 mmm. thick, cinnamon-brown, cell-contents granular; pedicel persistent, hyaline, or frequently tinted, up to 120 × 12 mmm.; germ-pore apical, conspicuous.

Host: *Polygonum aviculare* L. On leaves and stems. Herb. Nos. 8, 317. I, II, III. Lincoln (Canterbury), *T. Kirk!* 16th Nov., 1881. II, III. Tauranga (Auckland), *G. H. C.* 13th Jan., 1920. II, III. Alexandra (Otago), *A. H. Cockayne!* 10th Feb., 1921.

Distribution: Australia; North America; Europe; Africa; Asia.

Arthur (1917, p. 296) has by cultural experiments shown that the teleutospores of *Puccinia subnitens* Diet., when sown on *Polygonum aviculare*, produce spermogones and aecidia on that host, and claims in consequence that the aecidia "hitherto erroneously associated with *U. Polygoni*" are of *P. subnitens* and not of *U. Polygoni*. In America this may be so, but in New Zealand all three stages have been collected at the same time on the same host plant; and, moreover, as *P. subnitens* has not been collected in New Zealand, it would appear that Arthur's supposition is not applicable here.

6. **Uromyces Betae** Leveille. (Text-fig. 11, and Plate 77, fig. 3.) Chenopodiaceae (4).

Lev., *Ann. Sci. Nat.*, ser. 3, vol. 8, p. 375, 1847.

Uredo Betae Pers., *Syn. Fung.*, p. 220, 1801. *Caeoma Betarum* Link., in Willd. *Sp. Pl.*, vol. 6, p. 11, 1825. *Trichobasis Betae* Lev.: Cke. in *Micro. Fungi.*, p. 209, 1865. *Aecidium Betae* Kuhn., *Zeitschr. Landv. Central-Ver. Suchs.*, vol. 26, p. 41, 1869. *Caeomurus Betae* Kuntze, *Rev. Gen.*, vol. 3, p. 449, 1898. *Nigredo Betae* (Pers.) Arth., *Res. Sci. Congr. Bot. Vienne*, p. 343, 1906.

0. Spermogones amphigenous, in small groups, honey-coloured.

I. Aecidia amphigenous, crowded in irregular groups, on yellowish spots. Peridia cupulate, margins hyaline, reflexed, dentate. Spores globose to polygonal, 16–26 × 17–22 mmm.; epispore densely and finely verruculose, hyaline, 1·5–2 mmm. thick, cell-contents pale yellow.

II. Uredosori amphigenous, scattered, circular, up to 2 mm. diam., cinnamon-brown, pulverulent, surrounded by the ruptured epidermis. Spores elliptical, frequently subglobose, 20–35 × 18–25 mmm.; epispore sparsely and finely echinulate, 2·5–3 mmm. thick, golden-brown, with 2–3 equatorial germ-pores on one face.

III. Teleutosori similar to uredosori but chestnut-brown. Spores broadly elliptical, frequently obovate, 24–35 × 18–25 mmm.; apex rounded, not or slightly (4 mmm.) thickened, base rounded; epispore smooth, 2·5–3 mmm. thick, golden-brown, cell-contents vacuolate; pedicel deciduous, hyaline, up to 30 × 8 mmm.; germ-pore apical, conspicuous, crowned with a prominent hyaline papilla.

Host: *Beta vulgaris* L. On leaves. Herb. Nos. 30, 32. II. Lincoln (Canterbury), *T. Kirk!* Nov., 1881. II, III. Weraroa (Wellington), *G. H. C.* May, Sept., 1919.

Distribution: Australia; South Africa; North America; Europe.

This species is common on cultivated red-beet, sugar-beet, and mangolds. The aecidia have not been collected in New Zealand, so that in all probability the rust is perpetuated by uredospores alone; these may be found the year around.

7. **Uromyces Fabae** de Bary. (Fig. 12.) Leguminosae (5).

De Bary, *Ann. Sci. Nat.*, ser. 4, vol. 20, p. 80, 1863.

Uredo Fabae Pers., in *Roem. Neues. Mag. Bot.*, vol. 1, p. 93, 1794. *U. Viciae-Fabae* Pers., *Syn. Fung.*, p. 221, 1801. *U. Viciae* Rebent., *Prodr. Fl. Neom.*, p. 355, 1804. *Caeoma leguminosarum* Schlecht., *Fl. Berol.*, vol. 2, p. 127, 1824. *Uromyces appendiculatus* Ung., *Einfl. Bodens.*, p. 216, 1836. *U. Viciae* Fcl., *Symb. Myc.*, p. 62, 1869. *Aecidium album* G. W. Clinton: Peck, *Ann. Rep. N.Y. State Mus.*, vol. 31, p. 43, 1879. *Uromyces polymorphus* Peck and Clinton: Peck, *l.c.* *Nigredo Fabae* (Pers.) Arth., *N. Am. Fl.*, vol. 7, p. 251, 1912.

0. Spermogones amphigenous, sparse, honey-coloured.

I. Aecidia hypophyllous, solitary or aggregated in small groups, seated on pale-yellow spots. Peridia cupulate, margins hyaline, revolute, finely lacerate. Spores elliptical, or polygonal, 18–25 × 16–20 mmm.; epispore densely verruculose, hyaline, 1–1·5 mmm. thick.

II. Uredosori amphigenous, scattered, circular, up to 1·5 mmm. diam., cinnamon-brown, pulverulent, surrounded by the ruptured epidermis. Spores globose, or elliptical, frequently obovate, 25–32 × 18–25 mmm.; epispore sparsely and finely echinulate, 1·5–2 mmm. thick, golden-brown, with 3–4 scattered germ-pores on one face.

III. Teleutosori amphigenous and caulicolous, on leaves similar to uredosori but chocolate-brown, on stems and petioles scattered and elliptical, or more commonly confluent and forming areas reaching a length of 25 mm. or more, compact, pulvinate, chocolate-brown, soon naked. Spores elliptical, frequently obovate, 30–45 × 18–25 mmm.; apex bluntly acuminate, or as frequently rounded, sometimes truncate, thickened up to 12 mmm., darker in colour, base attenuate; epispore smooth, 2–2·5 mmm. thick, dark chestnut-brown, cell-contents vacuolate; pedicel persistent, tinted, up to 120 × 10 mmm.; germ-pore apical, conspicuous.

Host: *Vicia Faba* L. On leaves, petioles, stems, and legumes. Herb. No. 31. II, III. Palmerston North (Wellington), *G. H. C.* April, June, 1919.

Distribution: Australia; North America; Europe; Asia; Ceylon.

The aecidia have not been collected in New Zealand. The teleutosori form conspicuous black masses on the petioles and stems. The rust is prevalent in New Zealand wherever the host is grown. It is distinguished by the thick apex and smooth epispore of the teleutospore.

8. **Uromyces flectens** Lagerheim.

Lagerh., *Svensk. Bot. Tidsskrift.*, vol. 3, p. 36, 1909.

Puccinia neurophila De Toni, *Sacc. Syll.*, vol. 7, p. 698, 1888.

0. Spermogones unknown.

III. Teleutosori amphigenous, and on petioles and veins, on inflated and distorted areas, scattered when elliptical and 1 mm. long or more, commonly confluent when up to 3 mm. long, bullate, pulverulent, chocolate-brown, long covered by the epidermis. Spores elliptical, subglobose, obovate, 18–27 × 15–22 mmm.; apex rounded, not thickened, base rounded; epispore finely warted, warts arranged in irregular striae, or less commonly smooth, 1·5 mmm. thick, chestnut-brown; pedicel deciduous, hyaline, subturbinate, short, 30 × 6 mmm.; germ-pore apical, conspicuous, papillate.

Hosts:—

Trifolium repens L. On leaves, petioles, and veins. Herb. No. 490. III. Cluny, Turakina (Wellington), *Mrs. M. Cunningham!* 3rd Jan., 1922.

Trifolium fragiferum L. On leaves and petioles. III. Kelburn (on plants imported from Australia), *E. Bruce Levy!* 9th Mar., 1922.

Distribution: Europe; Asia.

This species has been separated from *U. Trifolii-repentis* Liro because of the fact that only teleutosori occur in the cycle, and because of the larger sori, which are longer covered, and are more common on nerves and petioles.

9. **Uromyces striatus** Schroeter. (Fig. 13.)

Schroet., *Abhandl. Schles. Ges.*, p. 11, 1872.

Uredo apiculata var. *Trifolii* Strauss., *Ann. Wett.*, vol. 2, p. 97, 1810, *p.p.*

0. Spermogones hypophyllous, numerous, honey-coloured.

I. Aecidia hypophyllous, scattered. Peridia cupulate, margins white, revolute, lacerate. Spores polygonal, 18–23 mmm. diam.; epispore densely verruculose, hyaline, 1·5 mmm. thick, cell-contents orange.

II. Uredosori amphigenous, scattered, elliptical, up to 1·5 mm. long, pulverulent, cinnamon-brown, surrounded by the ruptured epidermis.

Spores subglobose to elliptical, 20–25 × 15–20 mmm.; epispore sparsely and finely echinulate, 2 mmm. thick, pallid brown, with 3–5 scattered, papillate germ-pores on one face.

III. Teleutosori similar to and intermixed with the uredosori, chestnut-brown. Spores obovate or subglobose, 18–25 × 15–18 mmm.; apex rounded, not or scarcely thickened, base usually rounded, seldom attenuate; epispore 2 mmm. thick, covered with warts, which are arranged in irregular longitudinal striae, cinnamon-brown; pedicel deciduous, hyaline, up to 30 × 8 mmm.; germ-pore apical, conspicuous, crowned with a narrow hyaline papilla.

Host: *Medicago sativa* L. On leaves and stems. Herb. No. 362. II, III. Blenheim (Marlborough), *J. G. Myers!* 13th Mar., 1921.

Distribution: Europe; North and South America (?).

The aecidia, which occur on *Euphorbia* spp., have not been collected in New Zealand. It is probable that *U. Medicaginis* Pass. is a synonym of this species, as from the description they appear to be identical. I have compared specimens of *U. striatus* on this host from America (kindly supplied by Mrs. F. W. Patterson) with the New Zealand material and find them to be identical. Distinguished by the strongly warted epispore.

10. Uromyces Trifolii Leveille. (Fig. 14*a*.)

Lev., *Ann. Sci. Nat.*, ser. 3, vol. 8, p. 371, 1847.

Puccinia Trifolii Hedw. f.: DC. in *Fl. Fr.*, vol. 2, p. 225, 1805. *Uredo fallens* Desmaz., *Pl. Crypt.*, 1325, 1843. *Trichobasis fallens* Cke., *Jour. Bot.*, vol. 4, p. 105, 1866. *Puccinia fallens* Cke., *Handbk.*, p. 508, 1871, *p.p.* *Uromyces fallens* Kern., *Phytopathology*, vol. 1, p. 6, 1911. *Nigredo fallens* (Desmaz.) Arth., *N. Am. Fl.*, vol. 7, p. 254, 1912.

0, I. Unknown.

II. Uredosori amphigenous, scattered, circular, up to 1 mm. diam., cinnamon-brown, pulverulent, surrounded by the ruptured epidermis. Spores subglobose to broadly elliptical, 20–28 × 18–25 mmm.; epispore sparsely and finely echinulate, 2–2·5 mmm. thick, golden brown, with 3–6 scattered germ-pores on one face, sometimes papillate.

III. Teleutosori associated with and scarcely distinguishable from the uredosori, chestnut-brown. Spores broadly elliptical, obovate, or sometimes globose, 20–30 × 16–22 mmm.; apex rounded, not thickened, base attenuate, seldom rounded; epispore smooth, or with a few scattered warts, 1·5 mmm. thick, cinnamon-brown, cell-contents granular; pedicel deciduous, hyaline, short, frequently turbinate, up to 30 × 6 mmm.; germ-pore varying in position from apical to half-way down side, conspicuous, covered with a prominent hyaline papilla.

Hosts:—

Trifolium hybridum L. On leaves and stems. Herb. No. 321. II, III. Ettrick (Otago), *A. H. Cockayne!* 10 Feb., 1921.

Trifolium incarnatum L. On leaves. Herb. No. 321. II. Ruakura (Auckland), *G. H. C.* 28 Feb., 1921.

Trifolium pratense L. On leaves, petioles, and stems. Herb. No. 29. II, III. Marton, *C. Schwass!* 15 Feb., 1921. Weraroa (Wellington), *G. H. C.* 5 May, 1919.

Trifolium subterraneum L. On leaves. Herb. No. 29. II. Weraroa (Wellington), *G. H. C.* 16 June, 1919.

Distribution: North America; Europe; Asia Minor; Persia.

In the sori one sometimes finds teleutospores with two distinct germ-pores (figs. 14*a*, 4, and 5). Liro (1906, p. 15) separated from *U. Trifolii* the form occurring on *Trifolium repens* because it would not infect *T. hybridum* and *T. pratense*, and gave to it the name of *U. Trifolii-repentis*. These two forms are maintained as distinct species by Sydow (1910, p. 131) because of the absence of aecidia and the presence of a larger number (3–6) of scattered germ-pores in *U. Trifolii*. A third form, *U. flectens*, on *T. repens*, was in 1909 separated by Lagerheim, as only teleutospores occur in the cycle, these appearing in sori which are larger, appear more frequently on the petioles and veins, and are longer covered by the epidermis.

11. **Uromyces Trifolii-repentis** Liro. (Fig. 14*b*.)

Liro, *Act. Soc. Faun. Flor. Fenn.*, vol. 29, p. 15, 1906.

Uromyces Trifolii Plow., *Ured.*, p. 124, 1889, *p.p.* *Trichobasis fallens* Cke., *Micr. Fung.*, p. 226, 1865, *p.p.* *Puccinia fallens* Cke., *Handbk.*, p. 508, 1871, *p.p.* *Nigredo Trifolii* Arth., *N. Am. Fl.*, vol. 7, p. 255, 1912.

0. Spermogones epiphyllous, in minute clusters, immersed, honey-coloured.

I. Aecidia hypophyllous and on petioles, in circular or elliptical groups, up to 5 mm. diam., crowded, pallid yellow. Peridia cupulate, margins expanded but not or scarcely revolute, white, laciniate. Spores polygonal, 18–25 × 15–17 mmm.; epispore finely and densely verruculose, 1 mmm. thick, hyaline, cell-contents pale orange.

II. Uredosori amphigenous, and on petioles, cinnamon-brown, scattered, or confluent and linear, circular, minute, up to 0·5 mm. diam., bullate, pulverulent, surrounded by the ruptured epidermis. Spores globose, elliptical, or obovate, 17–25 × 16–22 mmm.; epispore sparsely and somewhat coarsely echinulate, 1·5 mmm. thick, golden-brown, with 2–4 (usually 2) equatorial germ-pores on one face.

III. Teleutosori amphigenous, on leaves circular, minute, 0·5 mm. diam., on petioles linear, up to 5 mm. long, chocolate-brown, bullate, pulverulent, long covered. Spores globose, elliptical, or obovate, 18–28 × 15–22 mmm.; apex rounded, not or scarcely thickened, base rounded, epispore smooth or with a few scattered and minute warts, 1·5–2 mmm. thick, chestnut-brown; pedicel deciduous, hyaline, commonly subturbinate, short, up to 45 × 6 mmm.; germ-pore apical, or one-third way down side, conspicuous, covered with a prominent hyaline papilla.

Host: *Trifolium hybridum* L. On leaves and petioles. Herb. No. 501. I, II, III. Ruakura (Auckland), *A. W. Green!* 9 Jan., 1922.

Distribution: Australia; North and South America; Europe; Asia.

Distinguished by the presence of all three spore-stages, and by the smaller number of germ-pores in the uredospores.

12. **Uromyces Discariae** n. sp. (Text-fig. 15, and Plate 77, fig. 1.)

Rhamnaceae (6).

Aecidium Discariae Cke., *Grev.*, vol. 14, p. 89, 1886.

0. Spermogones hypophyllous, preceding the aecidia, in confluent groups, sometimes circinnate, minute, immersed, honey-coloured.

I. Aecidia hypophyllous, closely aggregated on yellow spots which are visible on the upper surface. Peridia tubular, standing above the leaf-surface 1 mm., bright orange, margins erect, hyaline, dentate.

Spores polygonal or globose, 26–32 × 22–26 mmm.; epispore hyaline, 1·5–2 mmm. thick, densely and minutely verruculose, cell-contents orange, vacuolate.

III. Teleutosori hypophyllous, scattered, seated on yellow spots, chocolate-brown, pulvinate, compact, circular or more commonly elliptical, up to 5 mm. long, long covered. Spores elliptical or subglobose, irregular, 23–33 × 15–21 mmm.; apex acuminate or bluntly rounded, thickened up to 10 mmm., base abruptly attenuate, seldom rounded; epispore smooth, 2 mmm. thick, chestnut-brown, cell-contents granular, nucleus evident; pedicel persistent, tinted, up to 80 × 5 mmm.; germ-pore apical, conspicuous.

Host: *Discaria toumatou* Raoul. On leaves. Herb. No. 43. I. Otekaike (Otago), *T. Kirk!* 1889. Loburn; Dunstan Mountains (Otago), 3–500 m., *W. D. Reid!* Dec., 1921. I, III. Paradise (Otago), 500 m., *W. D. Reid!* 11 Dec., 1921. (Type.) III. Queenstown Domain; Cardrona Valley; Ben Lomond Track (Otago) *W. D. Reid!* Mar., April, 1921.

The host is endemic and widely distributed. The aecidia were in 1889 collected and sent to Kew by the late Mr. T. Kirk. Recently Mr. Reid has collected and forwarded abundant specimens of both stages.

13. Uromyces puccinioides Berkeley and F. von Mueller. (Fig. 16.)
Goodeniaceae (7).

Berk. et F. v. M., *Linn. Jour. Bot.*, vol. 13, p. 173, 1872.

0. Unknown.

I. Aecidia amphigenous, scattered, erumpent. Peridia cupulate, margins hyaline, erect, dentate. Spores elliptical, frequently polygonal, 20–25 × 12–18 mmm.; epispore hyaline, finely and densely verruculose, 1 mmm. thick, cell-contents pale-yellow, granular.

II. Uredosori amphigenous, scattered, irregular, frequently elliptical, up to 3 mm. long, bullate, pulverulent, cinnamon-brown, finally becoming exposed by the epidermis fissuring longitudinally. Spores globose or subglobose, seldom elliptical, 25–35 mmm. diameter; epispore sparsely aculeate, 1·5–2 mmm. thick, pale brown, with 2 equatorial germ-pores on one face.

III Teleutosori mixed with and indistinguishable from the uredosori. Spores elliptical, obovate, often pyriform, 28–35 × 18–26 mmm.; apex bluntly rounded, thickened up to 5 mmm., base subattenuate; epispore smooth, 1·5–2 mmm. thick, pale chestnut-brown, cell-contents vacuolate; pedicel persistent, hyaline, up to 45 × 8 mmm.; germ-pore apical, conspicuous.

Host: *Selliera radicans* Cav. On leaves. Herb. Nos. 189, 326. I. Evans Bay (Wellington), *T. Kirk!* 1884. II, III. Mouth of Hutt River (Wellington), *E. H. Atkinson!* 2 Feb., 1921. I, II. Ashburton (Canterbury), *H. H. Allan!* 14th Jan., 1920. I. Dunstan Mountains (Otago), *A. H. Cockayne!* 6 Feb., 1921. I, II, III. Dunstan Mountains (Otago), *W. D. Reid!* Dec., 1921.

Distribution: Australia.

The host is indigenous and widespread; it occurs also in Australia (Cheeseman, 1906, p. 394). McAlpine's description (1906, p. 91) does not altogether agree with the above, differing chiefly in the absence of uredospores. Comparison with Australian material, however, shows the teleutospores to be very similar to one another.

2. UROMYCLADIUM McAlpine.

McAlp., *Ann. Myc.*, vol. 3, p. 303, 1905.

Autoecious. Cycle of development includes 0, II, III.

0. Spermogones subcuticular, aparaphysate, subglobose, preceding or accompanying uredosori or teleutosori, or both.

II. Uredosori without peridia, commonly pulverulent, aparaphysate, naked. Uredospores borne singly at the apices of hyaline pedicels, elliptical or fusoid; epispore warted or reticulated, with several (2–7) evident equatorial germ-pores.

III. Teleutosori commonly pulverulent, erumpent, naked. Teleutospores depressed globose, in clusters at or near the apex of a common pedicel (sporophore), clusters composed of one spore and a hyaline vesicle, or two or more spores with or without a vesicle; pedicel hyaline, septate; epispore smooth, warted, or striate, germ-pore apical, solitary, conspicuous.

New Zealand species 4, introduced.

This genus, with the exception of one species, is confined to Australasia, where it attacks but the one genus of host plant, *Acacia*. Two of the species form large galls on branches and pods; it is probable that the mycelium is perennial in these galls, as their surfaces become covered year after year with the ochraceous or cinnamon spore-masses. The genus is peculiar chiefly in the manner in which the teleutospores are borne on the pedicels. There may be a single teleutospore at the apex of the pedicel, with a hyaline vesicle immediately underneath; two spores without a vesicle; two spores and a vesicle; or three spores without a vesicle.

McAlpine records seven species for Australia.

1. **Uromycladium Robinsoni** McAlpine. (Figs. 17, 21*a*.)

Leguminosae (1).

McAlp., *Rusts Aus.*, p. 109, 1906.

0. Spermogones amphigenous, usually surrounded by the uredosori or teleutosori, in small groups, sparse, pallid brown.

II. Uredosori amphigenous, scattered, or more frequently crowded and forming circinnate groups up to 2 mm. diam., circular, or more often

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FIG. 17.—*Uromycladium Robinsoni* McAlp. Teleutospores from *Acacia melanoxylon* R. Br. *a*, teleutospore; *b*, pedicel; *c*, vesicle.

FIG. 18.—*Uromycladium alpinum* McAlp. Teleutospores from *Acacia dealbata* Link.

FIG. 19.—*Uromycladium notabile* McAlp. Teleutospores from *Acacia decurrens* Willd. No. 3 is immature; note thick walls.

FIG. 20.—*Uromycladium Tepperianum* (Sacc.) McAlp. Teleutospores from *Acacia armata* R. Br. No. 2 is immature.

FIG. 21*a*.—*Uromycladium Robinsoni* McAlp. Uredospores.

FIG. 21*b*.—*Uromycladium notabile* McAlp. Uredospores.

FIG. 22.—*Puccinia coronata* Cda. Uredo- and teleuto-spores from *Avena sativa* L.

FIG. 23.—*Puccinia dispersa* Erikss. et Henn. Teleutospores from *Secale cereale* L. No. 4 is a three-celled form.

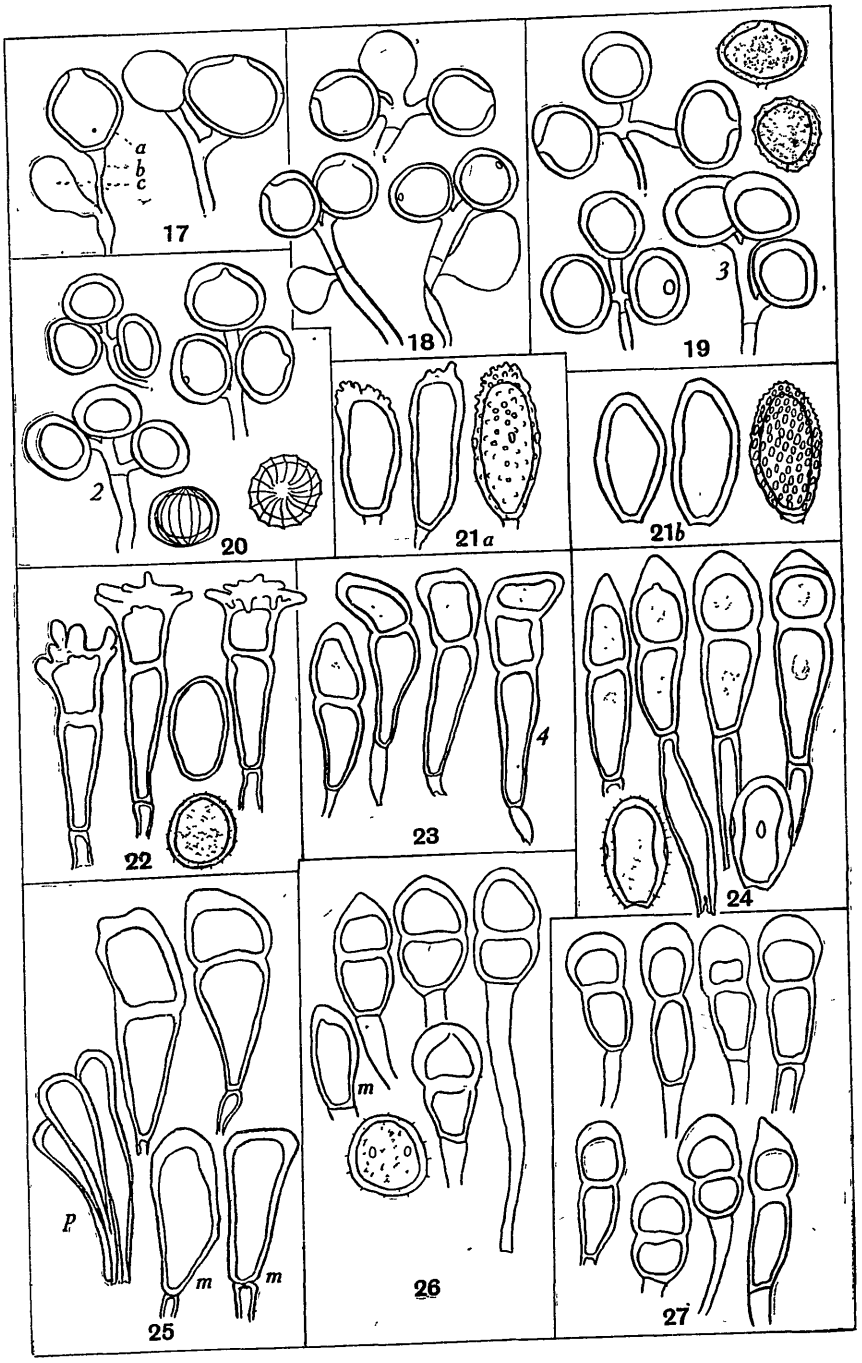
FIG. 24.—*Puccinia graminis* Pers. Uredo- and teleuto-spores from *Triticum vulgare* Vill.

FIG. 25.—*Puccinia simplex* Erikss. et Henn. Teleuto- and meso-spores from *Hordeum vulgare* L.

FIG. 26.—*Puccinia Sorghi* Schw. Uredo- and teleuto-spores from *Zea Mais* L.

FIG. 27.—*Puccinia Caricis* Shroet. Teleutospores from *Carex ternaria* Forst. f.

Camera-lucida drawings by author. All × 500. *m* = mesospores. *p* = paraphyses.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elliptical, pale chestnut-brown, pulverulent. Spores elliptical, less commonly fusoid, 38–45 × 19–22 mmm.; epispore closely and coarsely warted, pale yellowish-brown, 2 mmm. thick, thickened at the apex to 6 mmm., with 2–3 equatorial germ-pores on one face.

III. Teleutosori similar to and mixed with the uredosori, dark chestnut-brown. Spores solitary at the end of the pedicel, with a globose lateral vesicle beneath, depressed globose to globose, 19–26 × 25–34 mmm.; apex slightly thickened, 3–4 mmm.; epispore smooth, pale chestnut-brown, 1·5–2 mmm. thick; pedicel persistent, hyaline, fragile; germ-pore apical, conspicuous; vesicle globose to obovate, 16–24 mmm. diam., hyaline, wall smooth, delicate, pedicel persistent, hyaline, attached laterally to pedicel of spore.

X. Mesospores common, elliptical, 18–22 × 9–12 mmm.; epispore smooth, 1 mmm. thick, pale chestnut-brown, germ-pore absent.

Host: *Acacia melanoxylon* R. Br. On phyllodes. Herb. No. 285. II, III. Te Kauwhata (Auckland), *L. Paynter!* 11 Jan., 1921.

Distribution: Australia; Tasmania.

This species is distinguished by the presence of a single teleutospore at the apex of the pedicel, and a single hyaline lateral vesicle immediately beneath, and by the uredospore being coarsely warted, and thickened at the apex.

2. Uromycladium alpinum McAlpine. (Fig. 18.)

McAlp., *Rusts Aus.*, p. 105, 1906.

0. Spermogones amphigenous, crowded, seated on discoloured spots, associated with uredo- and teleuto-sori, black, minute.

II. Uredosori amphigenous, scattered, or in groups, elliptical, up to 3 mm. diam., cinnamon-brown, bullate, soon naked. Spores elliptical, or clavate, 35–51 × 21–26 mmm.; epispore covered with warts, which are densely and evenly arranged, golden-brown, not or slightly thickened at the apex, 2 mmm. thick, with 3–5 equatorial germ-pores on one face.

III. Teleutosori amphigenous, in irregularly elliptical pulvinate groups, up to 10 mm. in length, compact, chocolate-brown, bullate, soon naked. Teleutospores two at apex of pedicel, each attached by a short lateral pedicel, with a hyaline lateral vesicle immediately beneath, depressed globose to globose, 19–22 × 25–30 mmm.; apex slightly (3–3·5 mmm.) thickened; epispore smooth, 1·5–2 mmm. thick, yellowish to chestnut-brown; germ-pore apical, conspicuous; pedicel hyaline, persistent, up to 120 × 6 mmm.; vesicle arising from pedicel immediately below septum, attached by a short hyaline lateral pedicel, obovate to globose, up to 25 mmm. diam., wall smooth, hyaline.

X. Mesospores common, elliptical to obovate, 15–25 × 10–15 mmm.; apex not thickened, germ-pore absent.

Hosts:—

Acacia dealbata Link. On leaves. Herb. No. 431. Tauranga (Auckland), *G. H. C.* 17 Jan., 1920.

Acacia decurrens Willd. On leaves and branches. Pukekino, Hastings (Hawke's Bay), *F. B. Logan!* 3 Jan., 1921.

Distribution: Australia; Tasmania.

This species may readily be recognized by the two apical teleutospores attached to the common pedicel. The teleutospores are smooth, and possess a thin epispore. The uredospores are usually clavate, and are evenly warted all over.

3. **Uromycladium notabile** McAlpine. (Figs. 19, 21*b*.)

McAlp., *Rusts Aus.*, p. 108, 1906.

Uredo notabilis Ludw., *Bot. Centrbl.*, vol. 43, p. 6, 1890.

0. Spermogones associated with the uredo- and teleuto-sori, amphigenous and caulicolous, minute, black.

II. Uredosori on branches and pods, seated on distorted inflated galls, ochraceous, pulverulent, covering entire surfaces, naked. Spores elliptical or commonly fusoid, 30–45 × 18–28 mmm.; epispore strongly reticulated, 3 mmm. thick, yellowish-brown, apex not or slightly thickened, with 3–5 equatorial germ-pores on one face.

III. Teleutosori on branches and pods, seated on distorted inflated galls, chocolate-brown, pulverulent, naked. Spores in clusters of three attached to the apex of a common pedicel by short lateral pedicels, vesicle absent, depressed globose, often somewhat angular, 16–23 × 21–26 mmm.; apex thickened, up to 4 mmm.; epispore densely covered with fine warts, which are arranged in lines converging at the poles, pale chestnut-brown, 1·5–2 mmm. thick; pedicel hyaline, deciduous, up to 45 × 5 mmm.; germ-pore apical, conspicuous.

Hosts:—

Acacia dealbata Link. On branches and pods. Herb. Nos. 271, 355. II, III. Tauranga (Auckland), *G. H. C.* 17 Jan., 1920.

Acacia decurrens Willd. On branches. II. Pukekino, Hastings, *F. B. Logan!* 3 Jan., 1920.

Distribution: Australia; Tasmania.

Readily recognized by the gall-forming habit. The uredospores are ochraceous in mass, and the epispore is strongly reticulated, thus distinguishing it from any other species. The teleutospores are readily separable from their pedicels, and it is thus difficult to make out the grouping. Nevertheless, as the epispore is covered with fine striae, formed of fine warts arranged in lines, the species is readily determinable.

4. **Uromycladium Tepperianum** (Saccardo) McAlpine. (Fig. 20.)

McAlp., *Rusts Aus.*, p. 111, 1906.

Uromyces Tepperianus Sacc., *Hedw.*, vol. 28, p. 126, 1889.

0. Spermogones amphigenous, associated with the teleutosori, scattered, minute, chocolate-brown.

III. Teleutosori on branches, seated on distorted inflated galls, cinnamon-brown, pulverulent, naked. Spores in clusters of three, attached by a short lateral pedicel to the common pedicel, vesicle absent, depressed globose or subglobose, 14–17 × 18–25 mmm.; apex slightly (3 mmm.) thickened; epispore strongly striate, striae continuous and converging at the poles, 1–1·5 mmm. thick, cinnamon-brown; pedicel deciduous, hyaline, up to 80 × 5 mmm.; germ-pore apical, conspicuous.

Host: *Acacia armata* R. Br. On branches. Herb. No. 354. III. Auckland, *D. Miller!* 15 Feb., 1921.

Distribution: Australia; Tasmania.

The teleutospores occur in groups of three near the apex of the common pedicel; owing to their deciduous nature, this grouping is difficult to make out in mature sori, but may readily be seen in immature specimens. The species is, however, readily determined by the striate epispore of the teleutospore. This species forms large galls on the branches of the host. McAlpine records finding a gall weighing 3 lb. No uredospores are known.

3. Puccinia Persoon.

Pers., *Tent. Disp. Meth.*, p. 38, 1794.

Bullaria DC., *Fl. Fr.*, vol. 2, p. 226, 1805. *Dicaeoma* S. F. Gray, *Nat. Arr. Brit. Pl.*, vol. 1, p. 541, 1821. *Solenodonta* Cast., *Cat. Pl. Mars.*, p. 202, 1845. *Eriosporangium* Bertero: Lev., *Ann. Sci. Nat.*, ser. 3, vol. 5, p. 269, 1846. *Trichobasis* Lev., *Orb. Dict. Hist. Nat.*, vol. 12, p. 785, 1848. *Ceratitium* Rab., *Bot. Zeits.*, vol. 9, p. 451, 1851. *Cutomyces* Thuem., *Jor. Sci. Lisboa*, vol. 6, p. 239, 1878. *Rostrupia* Lagerh., *Jour. de Bot.*, vol. 3, p. 188, 1889. *Jackya* Bubak, *Oesterr. Bot. Zeits.*, vol. 52, p. 42, 1902. *Micropuccinia* Rostr., *Plantep. Haandb.*, p. 266, 1902. *Leptopuccinia* Rostr., *l.c.*, p. 268. *Tranzschelia* Arth., *Result Sci. Congr. Bot. Vienne*, p. 340, 1906. *Polythelis* Arth., *l.c.*, p. 341. *Allodus* Arth., *l.c.*, p. 345. *Dasyspora* Arth., *l.c.*, p. 346. *Poloma* Arth., *Jour. Myc.*, vol. 13, p. 29, 1907. *Nephlyctis* Arth., *l.c.*, p. 31. *Prospodium* Arth., *l.c.* *Argomyces* Arth., *N. Am. Fl.*, vol. 7, p. 217, 1912. *Sclerotelium* Sydow, *Ann. Myc.*, vol. 19, p. 172, 1921. *Coronotelium* Syd., *l.c.* *Peristemma* Syd., *l.c.*, p. 175. *Schroeterella* Syd., *ibid.*, vol. 20, p. 119, 1922. *Trailia* Syd., *l.c.*, p. 121.

Autoecious or heteroecious. Cycle of development includes 0, I, II, III.

0. Spermogones flask-shaped, immersed, the surrounding paraphyses alone protruding, honey-coloured.

I. Aecidia at first immersed, becoming erumpent and cupulate or cylindrical. Peridia hyaline, less frequently coloured, margins erect or revolute, dentate, lacerate, or seldom entire. Aecidiospores catenulate, commonly polygonal, less commonly elliptical; epispore usually verruculose, hyaline, seldom tinted, with numerous scattered and indistinct germ-pores.

II. Uredosori without peridia, commonly pulverulent, with or without paraphyses, and usually surrounded by the ruptured epidermis. Uredospores globose to obovate, borne singly at the apices of pedicels; epispore commonly echinulate, less frequently verrucose, coloured, with one or several evident germ-pores, which may be scattered over the surface or equatorially arranged.

III. Teleutosori compacted, less frequently pulverulent, naked or long covered by the epidermis. Teleutospores bicellular, borne singly on the apices of distinct pedicels; epispore smooth or variously sculptured, coloured or less commonly hyaline, with one distinct germ-pore in each cell, germ-pore varying in position from apex to base of each cell.

New Zealand species 57, of which 41 are indigenous, 21 being endemic.

This species is closely related to the genus *Uromyces*, being separated solely on account of the two-celled teleutospores.

Although in the introduction the full cycle was discussed, it does not follow that all species have a cycle including all spore-stages. For example, we have species with all stages present, or with one or more omitted, as under (0 = spermogones; I = aecidia; II = uredospores; III = teleutospores):—

0, I, II, III = Eu-form: *e.g.*, *Puccinia clavata* Syd.
0, I, III = Opsis-form: *e.g.*, *Puccinia distincta* McAlp.
0, II, III = Brachy-form: *e.g.*, *Puccinia obtegens* Tul.
0, III = Micro-form: *e.g.*, *Puccinia Plagianthi* McAlp.

As a rule, when spermogones accompany a stage it is an indication that that is the first stage to appear, and thus is some indication as to the length of the cycle; for example, if spermogones accompany the uredosori (primary) the aecidia are generally absent, and if spermogones accompany teleutosori, then both aecidia and uredospores are absent. Where the rust is heteroecious, with its aecidia on one host and uredo- and teleuto-sori on another, there is, as a rule, nothing to indicate the relationship between the two forms,

save the proximity of the two stages and their hosts. In such an instance cultural experiments are the only means of determining the relationships. Species are arranged under their host-families, the hosts being arranged according to the classification of Engler and Prantl. This treatment serves in some measure to split the genus (which now contains over 1,500 species) into groups, and brings all closely related species together. That this is necessary is evident when one considers the number that have been erected on host-distinctions alone.

1. Puccinia coronata Corda. (Fig. 22.) Gramineae (1).

Cda., *Icon. Fung.*, vol. 1, p. 6, 1837.

Aecidium Rhamni Pers., in J. F. Gmel. *Syst. Nat.*, vol. 2, 1472, 1791. *A. crassum* Pers., *Neues. Mag. Bot.*, vol. 1, p. 92, 1794. *A. Cathartici* Schum., *Enum. Pl. Saell.*, vol. 2, p. 225, 1803. *A. Allenii* G. W. Clinton: Peck, in *Ann. Rep. N.Y. State Mus.*, vol. 24, p. 93, 1872. *A. pulcherrimum* Rav.: Berk., in *Grev.*, vol. 3, p. 1874. *Puccinia Lolii* Niels., *Ugeskr. Landw.*, vol. 4, p. 549, 1875. *P. Rhamni* Wettst., *Vehr. Zool-Bot. Ges. Wien*, vol. 35, p. 545, 1886. *P. coronifera* Kleb., *Zeits. Pflanzenkr.*, vol. 4, p. 135, 1894. *P. Catharticae* Lagerh., *Tromosoe Mus. Aarsh.*, vol. 17, p. 52, 1895. *P. Melicae* Syd., *Mon. Ured.*, vol. 1, p. 760, 1902. *Dicaeoma Melicae* Arth., *Proc. Ind. Acad. Sci.*, 1903, p. 149, 1904. *Puccinia Beckmanniae* McAlp., *Rusts Aus.*, p. 116, 1906. *P. praegracilis* Arth., *Bull. Torr. Club*, vol. 34, p. 585, 1907. *P. Erikssonii* Bubak, *Arch. Nat. Land. Boehem.*, vol. 13, p. 107, 1908. *Dicaeoma Rhamni* (Pers.) Kuntze, *Rev. Gen.*, vol. 7, p. 470, 1898.

0. Spermogones amphigenous, associated with the aecidia, reddish-brown.

I. Aecidia amphigenous, compacted in small groups on yellow distorted spots, and on flowers and fruits, orange-yellow. Peridia cylindrical, margins hyaline, revolute, finely laciniate. Spores globose or broadly elliptical, 16–24 × 14–20 mmm.; epispore hyaline, closely and finely verruculose, 1–1·5 mmm. thick.

II. Uredosori amphigenous, and on sheaths, at first scattered and elliptical, becoming aggregated and often linear, frequently reaching a length of 2–3 mm., bullate, brownish-yellow, becoming pulverulent and naked. Uredospores globose, elliptical, or obovate, 22–30 × 18–25 mmm.; epispore finely and rather sparsely echinulate, 1–1·5 mmm. thick, pale yellow, with 3–4 scattered germ-pores on one face; a few hyaline capitate paraphyses sometimes present.

III. Teleutosori amphigenous, scattered, when 0·5 mm. long, or confluent and linear, frequently reaching a length of 2–3 mm., black, bullate, compact, long covered. Teleutospores elongate-clavate, often cuneiform, 40–60 × 11–20 mmm.; apex truncate, darker in colour, thickened, up to 7 mmm., and crowned with a variable number (5–8) of curved, digitate processes, variable in shape and size, frequently reaching a length of 10 mmm., base attenuate, basal cell longer, narrower, and much lighter in colour than the upper; not or slightly constricted at the septum; epispore smooth, yellowish-brown, 1–1·5 mmm. thick, cell-contents vacuolate; pedicel persistent, coloured, short, thick, continuous with the spore, up to 20 × 9 mmm.; germ-pore of upper cell apical, obscure, basal pore midway between septum and pedicel, obscure.

Hosts:—

Avena sativa L. On leaves and sheaths. Herb. Nos. 232, 301, 327. II, III. Waikanae (Wellington), *R. Waters!* 24 Nov., 1920. Ruakura (Auckland), *G. H. C.* 28 Feb., 1921.

Holcus lanatus L. On leaves, sheaths, and stems. Herb. Nos. 273, 318. II, III. Turakina; Weraroa; Kelburn (Wellington), *G. H. C.* Nov.–Jan., 1920–21. II, III. Ettrick (Otago), *A. H. Cockayne!* 10 Feb., 1921. II, III. Hooper's Inlet (Otago), *R. B. Tennent!* 21 Feb., 1921.

Lolium multiflorum Lam. Ruakura (Auckland), *A. W. Green!* 9 Jan., 1922.

Lolium perenne L. On leaves. Herb. No. 327. II. Ruakura (Auckland), *G. H. C.* 28 Feb., 1921. Kelburn (Wellington), *G. H. C.* Dec., 1921.

Distribution: World-wide.

The aecidial stage does not occur in New Zealand, so that in all probability the rust is perpetuated by the uredo stage alone. Viable uredospores are to be found on *Holcus lanatus* the year around.

Puccinia coronata was the name first applied by Corda to a species characterized by the coronate apex of the teleutospore. Nielsen (1875, p. 549) showed that when aecidiospores from *Rhamnus cathartica* were sown on leaves of *Lolium perenne* uredospores were produced, whereas aecidiospores from *Rhamnus Frangula* failed to infect this host. He therefore proposed to separate this latter form from *P. coronata* and to name it *P. Lolii*.

Klebahn (1894, p. 258) carried out similar experiments with the teleutospores from *Lolium perenne*, sowing them on *Rhamnus cathartica*, the result being the production of aecidia, whereas he failed to produce aecidia on *R. Frangula*. He therefore split *P. coronata* into two species, retaining the original name for the form with its aecidial stage on *Rhamnus Frangula*, and to the form with its aecidial stage on *P. cathartica* he proposed to give the name of *P. coronifera*, overlooking the fact that this form had previously been named by Nielsen.

Eriksson (1894, p. 292) showed by cultural experiments that *P. coronata* and *P. Lolii* each consisted of five biological races, as under:—

a. *Puccinia coronata* Cda. Aecidial stage on *Rhamnus Frangula*.
   1. f. *Calamagrostis*—on *Calamagrostis lanceolata* and *Phalaris*.
   2. f. *Phalaridis*—on *Phalaris arundinacea* and *Calamagrostis*.
   3. f. *Agrostis*—on *Agrostis stolonifera, A. alba*, and *A. vulgaris*.
   4. f. *Agropyri*—on *Agropyron repens*.
   5. f. *Holci*—on *Holcus lanatus* and *H. mollis*.

b. *Puccinia Lolii* Niels. Aecidial stage on *Ramnus cathartica*.
   1. f. *Avenae*—on *Avena sativa* and *A. fatua*.
   2. f. *Lolii*—on *Lolium perenne*.
   3. f. *Festucae*—on *Festuca elatior* and *F. gigantea*.
      (Klebahn showed that uredospores from *Festuca* would infect *Holcus lanatus, H. mollis*, and *Lolium perenne*.)
   4. f. *Alopecuri*—on *Alopecurus pratensis*, &c.
   5. f. *Glyceriae*—on *Glyceria aquatica*.

Klebahn added to this list
   6. f. *Holci*,
as he showed that uredospores from *Holcus lanatus* would infect only *Holcus lanatus* and *H. mollis*.

After further cultural work Eriksson (1908) revised his previous work and separated *P. Lolii* into eight biological races. Other workers have obtained entirely different results: for example, Carleton (1899), who claims that in North America there is only one host of *P. Lolii* in nature.

As there are few or no morphological differences between these two forms (the aecidial stages not occurring here), I have thought it advisable to include them under the original name, as Arthur and Fromme (1920, p. 313) have done; in this work they give a list of 40 hosts, embracing 21 genera.

2. Puccinia dispersa Eriksson and Henning. (Fig. 23.)

Erikss. et Henn., *Zeitschr. f. Plf.-Krankh.*, vol. 4, p. 141, 1894.

Aecidium Asperifolii Pers., *Obs. Myc.*, vol. 1, p. 97, 1796. *A. Lycopsidis* Desv., *Jour. de Bot. Desv.*, vol. 2, p. 311, 1809. *Uredo rubigo-vera* DC., *Fl. Fr.*, vol. 6, p. 83, 1815. *Puccinia recondita* Roberge: Desmaz., *Bull. Soc. Bot. Fr.*, vol. 4, p. 798, 1858. *P. straminis* Fcl., *Enum. Fung.*, vol. 9, p. 2, 1861. *P. rubigo-vera* Wint., in Rab., *Krypt. Fl.*, vol. 1, p. 217, 1881. *P. Asperifolii* Wettst., *Vehr. Zool.-Bot. Ges. Wien*, vol. 35, p. 541, 1886. *Aecidium Anchusae* Erikss. et Henn., *Getreider.*, p. 210, 1896. *Puccinia dispersa* (*sens. strict.*) Erikss., *Ann. Sci. Nat.*, ser. 8, vol. 9, p. 268, 1899. *P. Bromina* Erikss., *l.c.*, p. 271. *P. Holcina* Erikss., *l.c.*, p. 274. *Dicaeoma Asperifolii* (Pers.) Kuntze, *Rev. Gen.*, vol. 3, p. 466, 1898. *Puccinia Symphyti-Bromorum* F. Muell., *Beihefte. Bot. Centralb.*, vol. 10, p. 201, 1901. *P. Secalina* Grove, *Brit. Rust Fungi*, p. 261, 1913.

0. Spermogones amphigenous, scattered, or in compact groups, honey-coloured.

I. Aecidia amphigenous, and on calices, seated on spots which may reach a diam. of 2 mm., yellow. Peridia low, fairly broad, margins revolute, finely laciniate. Aecidiospores polygonal, subglobose, or elliptical, 20–31 × 15–22 mmm.; epispore closely and finely verruculose.

II. Uredosori amphigenous, light ferruginous-brown, elliptical or linear, 0·5–2 mm. long, rarely confluent, pulvinate, becoming pulverulent, surrounded by ruptured epidermis. Spores subglobose or elliptical, 22–30 × 22–25 mmm.; epispore finely and closely echinulate, 1·5–2 mmm. thick, yellowish-brown, with 4–6 scattered germ-pores on one face.

III. Teleutsori amphigenous, chiefly hypophyllous, black, elliptical, or more frequently linear, when up to 3 mm. long, long covered, divided into compartments and entirely surrounded by dark-brown, slightly clavate, stout paraphyses, which are as a rule firmly agglutinated together. Spores elongate-oblong to clavate, 40–65 × 12–22 mmm.; apex truncate, rounded, or bluntly acuminate, often oblique, thickened up to 5 mmm., more deeply coloured than rest of spore, base attenuate, basal cell narrower, longer, and lighter in colour than upper; slightly constricted at septum; epispore smooth, chestnut-brown, 2 mmm. thick in upper, 1 mmm. thick in lower cell; pedicel persistent, continuous with spore, coloured, stout, short, up to 21 × 7 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

Host: *Secale cereale* L. On leaves and sheaths. Herb. No. 302. II, III. Ruakura (Auckland), *A. H. Cockayne!* 27 Jan., 1921.

Distribution: Australia; North America; Europe; Asia Minor.

The aecidia, which occur on several hosts belonging to different genera, have not been collected in New Zealand.

Opinions are divided as to whether this should be classified as one or several species. Eriksson and Henning (*l.c.*) divided *Puccinia rubigo-vera* Wint. into three—*P. glumarum*, *P. simplex*, and *P. dispersa*—on account of certain morphological differences, chiefly in the uredosori. Shortly afterwards Eriksson (1894, p. 292) showed by cultural experiments that *P. glumarum* and *P. dispersa* each consisted of five biological races.

In 1899 Eriksson divided the original *P. rubigo-vera* into seven species, as under :—

1. *P. glumarum* Erikss. et Henn.—on wheat and *Bromus* spp. Aecidia unknown.
2. *P. dispersa* Erikss.—on rye. Aecidia on *Anchusa* spp.
3. *P. Triticina* Erikss.—on wheat. Aecidia unknown.
4. *P. Bromina* Erikss.—on *Bromus* spp. Aecidia unknown. (F. Mueller (1901) found that the aecidia of this race occur on *Symphytum officinale* L., and for this reason changed *P. Bromina* Erikss. to *P. Symphyti-Bromorum* Muell.)
5. *P. Agropyrina* Erikss.—on *Triticum repens*. Aecidia unknown.
6. *P. Holcina* Erikss.—on *Holcus lanatus* and *H. mollis*. Aecidia unknown.
7. *P. Triseti* Erikss.—on *Trisetum flavescens*. Aecidia unknown.
8. *P. simplex* Erikss. et Henn.—on barley. Aecidia unknown. (It has since been shown that the aecidial stage occurs on *Ornithogalum* spp.)

Of these, three should be allowed specific rank, as they show morphological differentiation; the others are identical in appearance and (if we exclude the presence or absence of aecidia—an uncertain character, as the aecidia are in so many instances unknown) should be considered merely as biological races.

Arthur and Fromme (1920, p. 333) have shown that the forms named by Eriksson *Puccinia Agropyrina* and *P. Triticina* belong to another species, *Dicaeoma Clematidis* (DC.) Arth. (= *Puccinia Elymi* Westnd.).

3. Puccinia graminis Persoon. (Text-fig. 24, and Plate 77, fig. 4.)

Pers., *Disp. Meth.*, p. 39, 1797.

Lycoperdon poculiforme Jacq., *Coll.*, vol. 1, p. 122, 1786. *Aecidium Berberidis* Pers., in J. F. Gmel., *Syst. Nat.*, vol. 2, p. 1473, 1791. *A. lineare* Pers., *l.c.* *Puccinia culmorum* Schum., *Enum. Pl. Saell.*, vol. 2, p. 233, 1801. *Aecidium Berberidis-cylindricum* Rebent., *Prodr. Fl. Neom.*, p. 352, 1804. *Puccinia cerealis* H. Mart., *Fl. Mosq.*, p. 183, 1812. *Dicaeoma graminis* S. F. Gray, *Nat. Arr. Brit. Pl.*, vol. 1, p. 541, 1821. *Caeoma Berberidis* Schlecht., *Fl. Berol.*, vol. 2, p. 112, 1824. *C. beriberidatum* Link., in Willd., *Sp. Pl.*, vol. 6, p. 57, 1825. *Puccinia Anthoxanthi* Fcl., *Jahrb. Nass. Ver.*, vol. 27, p. 15, 1873. *P. poculiformis* Wettst., *Vehr. Zool.-Bot. Ges. Wien*, vol. 35, p. 544, 1886. *P. Phlei-pratensis* Erikss. et Henn., *Zeits. Pflanzenkr.*, vol. 4, p. 140, 1894. *P. jubata* Ellis and Barth., *Erythea*, vol. 4, p. 2, 1896. *Dicaeoma poculiforme* (Jacq.) Kuntze, *Rev. Gen.*, vol. 3, p. 466, 1898. *D. Anthoxanthi* Kuntze, *l.c.*, p. 467. *Puccinia vilis* Arth., *Bull. Torr. Cl.*, vol. 28, p. 663, 1901. *P. Sesleriae-coerulae* E. Fisch., *Beitr. Krypt. Schweiz.*, vol. 2, p. 259, 1904. *Dicaeoma vile* Arth., *Res. Sci. Congr. Bot. Vienne*, p. 344, 1906. *Uredo quinqueporula* Arth. and Fromme, *Torreya*, vol. 15, p. 265, 1915.

O. Spermogones amphigenous, crowded in small groups which are seated on circular discoloured spots, honey-coloured.

I. Aecidia hypophyllous, caulicolous, and fructicolous, in crowded circular, inflated groups, on discoloured spots, up to 5 mm. diam., yellow. Peridia at first cylindrical, becoming cupulate, margins white, erect, becoming slightly expanded, dentate. Spores polygonal, subglobose, or elliptical, 14–26 mmm. diam.; epispore hyaline, 1–5 mmm. thick, thickened at apex, up to 7 mmm., finely and densely verruculose, cell-contents sulphur-yellow.

II. Uredosori amphigenous, and on stems, sheaths, and glumes, reddish-brown, scattered, or more frequently confluent when linear, attaining a

length of 2–3 mm., bullate, pulverulent, becoming exposed by the epidermis rupturing longitudinally. Spores elliptical, often obovate, sometimes subglobose, 20–38 × 14–20 mmm.; epispore coarsely and moderately echinulate, 1·5–2 mmm. thick, golden-brown, with 3–4 equatorial germ-pores on one face.

III. Teleutosori on sheaths, stems, and inflorescences, seldom on blades, at first scattered, becoming confluent and linear, attaining a length of 12 mm. or more, pulvinate, compact, black, at first covered, becoming naked and conspicuous. Spores elliptical, oblong-clavate, or clavate, 35–70 × 15–25 mmm.; apex acuminate, sometimes oblique, thickened, up to 12 mmm., more deeply coloured than rest of spore, base attenuate, basal cell longer and narrower than upper; constricted at septum; epispore smooth, up to 3 mmm. thick, chestnut-brown, cell-contents granular, nuclei conspicuous; pedicel persistent, coloured, more deeply at apex, continuous with spore, up to 90 × 9 mmm., equally thick throughout; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, conspicuous.

X. Mesospores common, elliptical, 30–45 × 11–15 mmm.; apex acuminate, frequently rounded, thickened.

Hosts :—

Avena sativa L. On blades, culms, and inflorescences. Herb. No. 323. II. Marton (Wellington), *C. H. Schwass !* 16 Feb., 1921. II, III. Ruakura (Auckland), *G. H. C.* 28 Feb., 1921.

Dactylis glomerata L. On blades and culms. Herb. No. 395. II, III. Springfield (Canterbury), 500 m., *W. D. Reid !* 18 June, 1921.

Festuca elatior L. On culms, leaves, and sheaths. Herb. No. 332. II, III. Helensville (Auckland), *E. Bruce Levy !* 15 Feb., 1921.

Festuca pratensis Huds. On culms. Herb. No. 347. II, III. Gore (Otago), *R. B. Tennent !* 4 May, 1921.

Lolium perenne L. On culms and leaves. Herb. No. 347. II, III. Gore (Otago), *R. B. Tennent !* 4 May, 1921.

Triticum vulgare Vill. On blades, culms, and inflorescences. Herb. No. 299, 300. II, III. Ruakura (Auckland), *A. H. Cockayne !* 25 Jan., 1921. II. Canterbury, *F. E. Ward !* 18 Feb., 1921.

Lolium multiflorum Lam. On leaves and culms. II, III. Moumahaki (Wellington), *J. W. Deem !* 9 Jan., 1922. Ruakura (Auckland), *A. W. Green !* 9 Jan., 1922.

Lolium temulentum L. On leaves and inflorescences. II, III. Moumahaki (Wellington), *J. W. Deem !* 9 Jan., 1922.

Distribution : World-wide.

The aecidia, which occur on *Berberis* spp., have not been collected in New Zealand. In Australia, McAlpine (1906, p. 67) proved that the Australian forms would not infect barberry; yet, although this is the case, wheat-rust is as prevalent there as in any country in the world. This would show that the aecidial stage is not essential to the perpetuation of the species. How, then, is the rust carried over from year to year ? Probably the most reasonable theory is that of the overwintering of uredospores on grasses; for, as has been shown by many experiments (Jacky, 1900; Bolley, 1898; Barclay, 1891), they are capable of remaining viable for a considerable period. It would appear that viability of uredospores is a matter of climate, as they appear to remain viable in warmer localities for a much longer period than in colder areas.

Recent work on the part of Stakman and Piemeisel (1917), and Stackman, Piemeisel, and Levine (1918), has shown that uredospores from grasses are capable of infecting cereals in the spring. For example, they showed (1917, p. 466) that uredospores from *Agropyron*, *Elymus*, and *Hordeum* would readily infect wheat.

Other theories have been put forward to account for this overwintering of the fungus—*e.g.*, that a perennial mycelium is present; but insufficient evidence was forthcoming in support, no mycelium being found in the host other than in the vicinity of uredosori. To account for epiphytotic recrudescences of wheat-rust, J. Eriksson (1897) propounded his remarkable mycoplasm theory, which (in brief) is to the effect that, in some manner not understood, the fungus is able to combine some of its protoplasm with that of the host, thus forming a symbiotic substance which he termed "mycoplasm." This mycoplasm is supposed to remain dormant in the leaf or seed until conditions become favourable, when the fungal elements become active, grow out into the leaf in the mycelial form, eventually giving rise to sori of uredospores! This remarkable hypothesis has been severely criticized by Marshall Ward (1903), who showed that the whole theory was based on a misinterpretation of the ordinary phenomena of uredospore infection.

It was with this species that de Bary (1865, p. 25) first proved that heteroecism existed in the rusts. Not only is this rust heteroecious, having its aecidia on one plant and its teleutospores on another, but is also known to consist of many biological races, each supposed to be incapable of infecting any host other than the one it occurs on.

For example, Eriksson (1894, p. 292) showed by numerous cultural experiments that this species consisted of a number of biological races (or, as he termed them, "*specialisierte Formen*"), as under:—

Puccinia graminis Pers. Aecidia on *Berberis vulgaris*.

1. f. *Secalis*—on rye.
2. f. *Avenae*—on oat.
3. f. *Tritici*—on wheat.
4. f. *Airae*—on *Aira caespitosa*.
5. f. *Agrostidis*—on *Agrostis* spp.
6. f. *Poae*—on *Poa* spp.

Carleton (1899), working with the same races in North America, obtained quite different results. He claims that there are but two biological races, as under:—

1. f. *Tritici*—on wheat, barley, cocksfoot, *Agrostis alba*, *Festuca gigantea*, *Koeleria cristata*, and *Hordeum murinum*.
2. f. *Avenae*—on *Avena sativa*, *A. fatua*, *A. pratensis*, *Hordeum murinum*, cocksfoot, *Koeleria cristata*, *Holcus mollis*, &c.

Jaczewski (1910, p. 321) from his cultural experiments obtained results which showed interrelationships between hosts quite distinct from Eriksson's.

Again, Freeman and Johnson (1911) found that uredospores of f. *Tritici* readily infected barley, but would not infect oats, and rarely rye; but by first infecting barley they could with the resultant uredospores taken from the barley readily infect rye, and with uredospores taken from the rye they could in turn infect oats, the barley and rye in these experiments acting as "bridging species."

Most of these results given above were obtained by using uredospores.

Arthur (1910, p. 228), after experimenting with teleutospores and aecidiospores, states: "Although in the uredinal stage this rust shows racial strains that inhibit the ready transfer from one species of host to

another . . . yet in the aecial stage racial strains play no part, and the barberry acts as a bridging host between each and every other gramineous host." In a later work Arthur and Fromme (1920, p. 295) include under this species races occurring on 97 different hosts (exclusive of the 8 aecidial hosts), belonging to 35 genera.

Stakman, Piemeisel, and Levine (1918), as the result of cultural work extending over a period of four seasons, are of the opinion that " bridging " does not occur; furthermore, they claim that the aecidium does not act as a bridging host, nor does it act as a reinvigorator of the rust.

It would appear that specialization is not as pronounced as Eriksson and others would have us believe; in fact, the conditions governing this specialization are so little understood, and the results obtained so contradictory, that little reliance can be placed on any arbitrary separation of biological races. This illustrates the inadvisability of basing species on biological distinctions alone, and strengthens Marshall Ward's contention that " no species can be accepted as valid until it is capable of definition in morphological terms " (1905, p. 18).

4. Puccinia Poarum Nielsen.

Niels., in *Botanisk. Tidsskrift*, vol. 3, p. 24, 1877.

Hosts :—

Poa annua L. On leaves. Herb. No. 314. II. Kelburn (Wellington), *G. H. C.* 3 Feb., 1921.

Poa pratensis L. On leaves. Herb. No. 286. II. Kelburn (Wellington), *G. H. C.* 12 Jan., 1921.

Distribution: Australia; North America; Europe; Japan.

As I have no teleutospore material from which to describe this species, I have merely recorded this rust, together with the hosts.

5. Puccinia simplex Eriksson and Henning. (Fig. 25.)

Erikss. et Henn., *Zeits. Pflanzenkr.*, vol. 4, p. 260, 1894.

Puccinia straminis simplex Koern., *Land. Forstw. Zeit.*, No. 50, 1865. *Uromyces Hordei* Niels., *Ugeskr. Landm.*, vol. 2, p. 567, 1874. *P. anomala* Rostr.: Thuem., *Fl.*, vol. 61, p. 92, 1878. *Aecidium ornithogaleum* Bubak, *Ann. Myc.*, vol. 3, p. 223, 1905. *Dicaeoma anomalum* (Rostr.) Arth. and Fromme, *N. Am. Fl.*, vol. 7, p. 339, 1920.

0. Spermogones amphigenous, in groups occupying large areas, honey-coloured.

I. Aecidia amphigenous, scattered. Peridia cupulate, opening by an apical pore. Spores elliptical, 18–30 mmm. diam., minutely and closely verruculose.

II. Uredosori amphigenous, seldom caulicolous, cinnamon-brown, scattered or confluent, up to to 2 mm. long, pulverulent, surrounded by the ruptured epidermis. Spores elliptical or obovate, 20–30 × 16–25 mmm.; epispore sparsely and finely echinulate, 1·5–2 mmm. thick, pallid brown, with 6 to 8 scattered germ-pores on one face, obscure.

III. Teleutosori amphigenous, scattered or confluent, elliptical, up to 1·5 mm. long, pulvinate, compact, black, long covered. Spores clavate to cuneiform, 50–65 × 20–25 mmm.; apex truncate, obtuse, or bluntly acuminate, thickened up to 6 mmm. or not thickened, base attenuate, basal cell longer, narrower, and lighter in colour than upper; slightly

constricted at the septum; epispore smooth, 1·5 mmm. thick, chestnut-brown; pedicel persistent, coloured, short, continuous with spore, up to 20 × 8 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure; paraphysate.

X. Mesospores more common than teleutospores, clavate, 30–50 × 20 mmm.

Host: *Hordeum vulgare* L. Herb. No. 322. II, III. Ruakura (Auckland), *G. H. C.* 28 Feb., 1921. Christchurch, *F. E. Ward!* 18 Feb., 1921. Otago, *W. B. Tennent!* 3 Mar., 1921. Weraroa (Wellington), *J. Beverley!* 3 Mar., 1921.

Distribution: Australia; North America; Europe.

This species is characterized by the prevalence of mesospores in the sori, and by the aecidia occurring on *Ornithogalum* spp. (they have not been collected in New Zealand), otherwise it is identical morphologically with *P. dispersa* Erikss. et Henn.

6. Puccinia Sorghi Schweinitz. (Fig. 26.)

Schw., *Trans. Am. Phil. Soc.*, ser. 11, vol. 4, p. 295, 1832.

Uredo Zeae Desmaz., *Ann. Sci. Nat.*, ser. 2, vol. 13, p. 182, 1840. *Puccinia Maydis* Bereng., *Atti. Sci. Ital.*, vol. 6, p. 475, 1845: *hyponym. P. Zeae* Bereng.: Klotzsch., *Herb. Viv. Myc.*, Suppl. 18, 1851. *Trichobasis Maydis* Niessl., *Abh. Nat. Ver. Bruenn*, vol. 3, p. 114, 1865. *Aecidium Oxalidis* Thuem., *Flora*, vol. 59, p. 425, 1876. *A. Peyritschianum* Magnus, *Ber. Nat. Med. Ver. Innsbruck*, vol. 21, p. 34, 1894.

0. Spermogones amphigenous, sparse, in small groups, honey-yellow.

I. Aecidia hypophyllous, in small more or less circular groups, minute. Peridia cupulate, margins erect, hyaline, irregularly lacerate, or entire. Spores globose or elliptical, 18–26 × 13–19 mmm; epispore pale yellow, 1–1·5 mmm. thick, finely and closely verruculose.

II. Uredosori amphigenous, scattered, elliptical, up to 1 mm. long, or confluent, forming lines up to 5 mm., bullate, pulverulent, epidermis fissuring longitudinally. Spores globose or subglobose, 22–30 mmm. diameter; epispore finely and sparsely echinulate, 1·5–2 mmm. thick, cinnamon-brown, with 3 equatorial germ-pores on one face.

III. Teleutosori amphigenous, scattered, rarely confluent, elliptical, up to 2 mm. long, pulvinate, compact, black, soon naked. Spores elliptical, 30–42 × 16–24 mmm.; apex rounded, often bluntly acuminate, thickened, up to 10 mmm., base attenuate, frequently rounded, both cells the same size and colour; slightly constricted at the septum; epispore chestnut-brown, smooth, 2–2·5 mmm. thick; pedicel persistent, coloured, up to 80 × 8 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, obscure.

Host: *Zea Mais* L. On leaves. Herb. No. 324. II. Ruakura (Auckland), *G. H. C.!* 28 Feb., 1921.

Distribution: Australia; North and South America; Africa; Europe.

The uredo stage alone had been collected in New Zealand. I am indebted to Mrs. F. W. Patterson, of the United States Department of Agriculture, Mycological Exchange, for teleutospore material from which the above description has been drawn up.

Arthur (1904, p. 64) proved that this is an heteroecious species. He sowed aecidiospores from *Oxalis cymosa* Small on maize-leaves, and in five days obtained spermogones and uredosori.

7. Puccinia Caricis Schroeter. (Fig. 27.) Cyperaceae (2).

Schroet., *Krypt. Fl. Schles.*, vol. 3, p. 327, 1887.

Aecidium Urticae Schum., *Enum. Pl. Saell.*, vol. 2, p. 222, 1803. *Uredo Caricis* Schum., *l.c.*, p. 231. *Caeoma Urticae* Schlecht., *Fl. Berol.*, vol. 2, p. 112, 1824. *C. urticatum* Link., in Willd., *Sp. Pl.*, vol. 6, p. 62, 1825. *Puccinia Urticae* Lagerh., *Mitt. Bad. Bot. Ver.*, vol. 2, p. 72, 1889. *Dicaeoma Urticae* Kuntze, *Rev. Gen.*, vol. 3, p. 467, 1898. *D. Caricis* Kuntze, *l.c.*, p. 468. *Puccinia Garrettii* Arth., *Bull. Torr. Cl.*, vol. 32, p. 41, 1905. *Uredo fatiscens* Arth., *Bull. Torr. Cl.*, vol. 42, p. 593, 1915. *Puccinia urticata* Kern., *Mycologia*, vol. 9, p. 214, 1917.

0. Spermogones amphigenous, conspicuous, in groups on discoloured spots, honey-coloured.

I. Aecidia amphigenous and caulicolous, scattered, or more frequently in crowded groups on discoloured inflated and distorted areas, orange-yellow. Peridia cupulate, margins spreading, revolute, lacerate, white. Spores globose or polygonal, 18–25 × 15–22 mmm.; epispore pale yellow, densely and finely verruculose, 1 mmm. thick, cell-contents orange-yellow.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, elliptical, up to 0·5 mm. long, or confluent and linear, reaching a length of 1 cm. or more, pulverulent, bullate, cinnamon-brown, surrounded by the ruptured epidermis. Spores elliptical, frequently obovate, 24–32 × 18–25 mmm.; epispore golden-brown, sparsely and coarsely echinulate, 1·5–2 mmm. thick, with 2–3 equatorial germ-pores on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, scattered, elliptical, up to 1 mm. long, or confluent, forming lines up to 5 mm., chocolate-brown, pulvinate, compact, surrounded by the ruptured epidermis. Spores clavate, 35–65 × 15–25 mmm.; apex rounded, sometimes bluntly acuminate, thickened, up to 12 mmm., base attenuate, basal cell longer, narrower, and lighter in colour than the upper; constricted at the septum; epispore smooth, chestnut-brown, 1·5–2 mmm. thick; pedicel persistent, continuous with the spore, coloured, stout, up to 54 × 10 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

X. Mesospores uncommon, elongate elliptical, 35–44 × 12–16 mmm.; apex thickened and bluntly acuminate.

Hosts:—

Urtica aspera Petrie. On leaves and stems. I. Macraes (Otago), 300 m., *W. D. Reid!* 2 Dec., 1921.

Urtica linearifolia (Hook. f.) Cockayne. On leaves, veins, petioles, and stems. Herb. No. 424. I. Swamp, Weraroa sandhills (Wellington), *E. H. Atkinson!* 20 Oct., 1921.

Carex Berggreni Petrie. On leaves. Herb. No. 365. II, III. Kinloch (Otago), 370 m., *W. D. Reid!* 2 May, 1921.

Carex Buchanani Berggr. On leaves. Herb. No. 366. II. Creek-bed, Dunstan Mountains (Otago), 300 m., *W. D. Reid!* 21 May, 1921.

Carex Colensoi Boott. On leaves. II, III. Glenorchy (Otago), *W. D. Reid!* 15 Dec., 1921.

Carex dipsacea Berggr. On leaves. Herb. No. 368. II. Tokomaru (Wellington), *E. H. Atkinson!* 1 Feb., 1921.

Carex Gaudichaudiana (Boott) Kunth. On leaves. II, III. Mount Judah (Otago), 900 m., *W. D. Reid!* 14 Dec., 1921.

Carex pumila Thunb. On leaves and culms. Herb. No. 370. II, III. Seashore, Wellington, *E. H. Atkinson!* 27 Jan., 1921.

Carex resectans Cheesm. On leaves. Herb. No. 366. II. Dunstan Mountains; Mount Judah (Otago), 900 m.; *W. D. Reid!* Feb., Dec., 1921.

Carex stellulata Good. On leaves. Herb. No. 365. II, III. Lake Harris Track (Otago), 1,140 m., *W. D. Reid!* 6 May, 1921.

Carex ternaria Forst. f. On leaves and culms. Herb. Nos. 367, 369. II, III. Seashore, Wellington Heads, *G. H. C.* 27 Jan., 1921.

Distribution: Australia; North America; Europe; Siberia; Japan.

All the hosts are indigenous, the majority being endemic (Cheeseman, 1906). Magnus in 1872 first showed that the aecidium on *Urtica* was a phase in the life-cycle of *P. Caricis*. Arthur and Kern (1920, pp. 352–69) describe nineteen species of *Puccinia* on *Carex;* of these the majority are separated on aecidial and uredospore characters, the former as the result of many cultural experiments. I have no doubt there are several species in New Zealand, as there is considerable variation in the uredospore characters. I prefer to group them under the one species until such time as I am able by cultural experiments to separate them, rather than to describe many uredo forms alone.

8. Puccinia Unciniarum Dietel and Neger. (Fig. 28.)

Diet. et Neg., *Engl. Bot. Jahrb.*, vol. 22, p. 351, 1896.

0, I. Unknown.

II. Uredosori amphigenous, scattered, minute, 0·5 mm. diam., circular, pulverulent, chestnut-brown, surrounded by the ruptured epidermis. Spores subglobose, elliptical, or often obovate, 23–30 × 17–25 mmm; epispore 2 mmm. thick, cinnamon-brown, finely and sparsely echinulate, with 3–4 scattered germ-pores on one face.

III. Teleutosori hypophyllous, minute, circular, 0·5 mm. diam., pulvinate, compact, dark chocolate-brown, soon naked. Spores elongate-oblong, frequently fusoid, 48–55 × 15–20 mmm.; apex rounded, rarely attenuate, thickened up to 10 mmm., base attenuate, basal cell narrower and somewhat longer than the upper; constricted at the septum; epispore

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Fig. 28.—*Puccinia Unciniarum* Diet. et Neg. Uredo- and teleuto-spores from *Uncinia compacta* R. Br.

Fig. 29.—*Puccinia juncophila* Cke. et Mass. Uredo- and teleuto-spores from *Juncus vaginatus* R. Br.

Fig. 30.—*Puccinia obscura* Schroet. Uredo- and teleuto-spores from *Luzula campestris* DC.

Fig. 31.—*Puccinia Kirkii* sp. nov. Uredo- and teleuto-spores from *Rumex flexuosus* Sol.

Fig. 32.—*Puccinia tiritea* sp. nov. Uredo- and teleuto-spores from *Muehlenbeckia australis* (Forst. f.) Meissn.

Fig. 33.—*Puccinia Tetragoniae* McAlp. Teleutospores from *Tetragonia implexicoma* Hook. f.

Fig. 34.—*Puccinia clavata* Syd. Teleutospores from *Clematis foetida* Raoul.

Fig. 35.—*Puccinia contegens* sp. nov. Teleutospores from *Ranunculus multiscapus* Hook. f. *m* = mesospore. No. 5 is a small form of which about 5 per cent. are present in the sori.

Fig. 36.—*Puccinia inornata* sp. nov. Teleutospores from *Cardamine heterophylla* (Forst. f.) O. E. Schultz. No. 5 is germinating.

Fig. 37.—*Puccinia Reidii* sp. nov. Teleutospores from *Radicula* sp. ined.

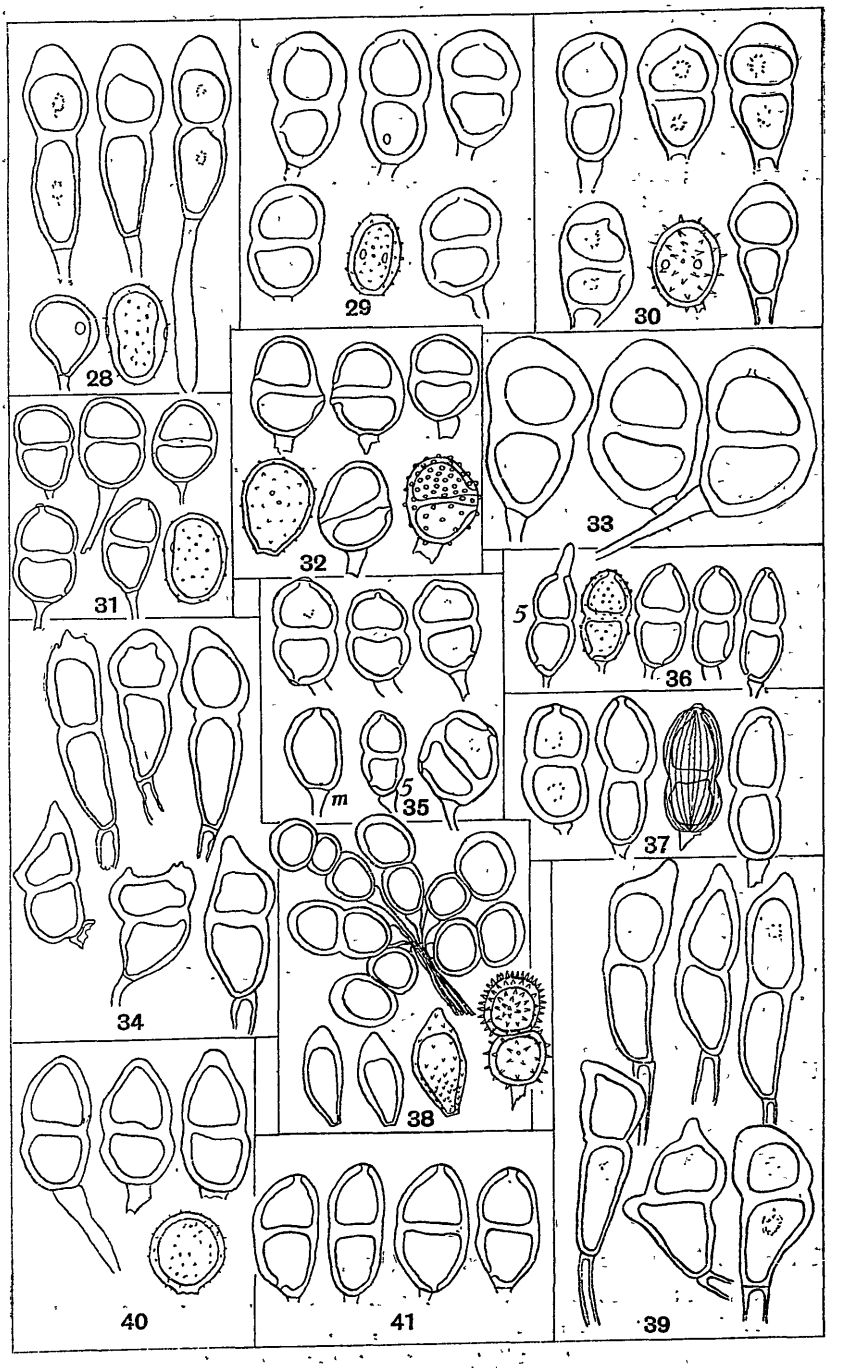
Fig. 38.—*Puccinia Pruni-spinosae* Pers. Uredo- and teleuto-spores from *Prunus domestica* L.; showing a group of teleutospores with their pedicels agglutinated together. A three-celled form is present.

Fig. 39.—*Puccinia Morrisoni* McAlp. Teleutospores from *Pelargonium inodorum* Willd.

Fig. 40.—*Puccinia granularis* Kalch. et Cke. Uredo- and teleuto-spores from *Pelargonium zonale* L'Herit.

Fig. 41.—*Puccinia Hoheriae* sp. nov. Teleutospores from *Hoheria populnea* A. Cunn.

Camera-lucida drawings by author. All × 500.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smooth, 1·5–2 mmm. thick, pale brown, cell-contents granular, nuclei conspicuous; pedicel persistent, tinted, up to 60 × 8 mmm., continuous with the spore; germ-pore of the upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores common, elliptical, 35–42 × 18 mmm.; epispore smooth.

Host: *Uncinia compacta* R. Br. On leaves. Herb. No. 352. II, III. Mount Dick; Kinloch (Otago), 840 m., *W. D. Reid!* April, May, 1921.

Distribution: Chile.

The host is indigenous, is widespread throughout the mountainous regions of both Islands (Cheeseman 1906, p. 800), and occurs also in Australia. This rust shows a general resemblance to *P. Caricis*, but the narrow fusoid teleutospore distinguishes it. It is apparently rare, and has hitherto been recorded only from Chile.

9. **Puccinia juncophila** Cooke and Massee. (Fig. 29.) Juncaceae (3).

Cke. et Mass., *Grev.*, vol. 22, p. 37, 1893.

Uredo armillata Ludw., *Bot. Centrabl.*, vol. 43, p. 8, 1890.

0, I. Unknown.

II. Uredosori amphigenous, cinnamon-brown, scattered when elliptical and 1 mm. long, or more commonly confluent and forming lines up to 10 mm. long, pulverulent, bullate, surrounded and partly covered by the ruptured epidermis. Spores subglobose, obovate, or elliptical, 22–32 × 15–22 mmm.; epispore coarsely and sparsely echinulate, yellowish-brown, 2–3 mmm. thick, with 2–3 equatorial germ-pores on one face.

III. Teleutosori amphigenous, elliptical, often confluent and up to 5 mm. long, pulverulent, chocolate-brown, surrounded by the ruptured epidermis. Spores elliptical, 30–40 × 20–28 mmm.; apex rounded, slightly (5–6 mmm.) or not thickened, base rounded, seldom subattenuate, both cells same size and colour, cell-contents granular; slightly constricted at the septum; epispore smooth, yellowish-brown, 3–4 mmm. thick; pedicel deciduous, hyaline, up to 50 × 5 mmm., often obliquely attached; germ-pore of upper cell apical, conspicuous, basal pore one-third to two-thirds below septum, obscure.

X. Mesospores uncommon, elliptical, or subglobose, 23–28 × 19–21 mmm.

Host: *Juncus vaginatus* R. Br. On leaves and culms. Herb. No. 262. II. Tokomaru (Wellington). 5 Nov., 1920. II, III. Tasman (Nelson), *G. H. C.* 17 Nov., 1921.

Distribution: Australia; Tasmania.

The uredo stage of this rust forms conspicuous cinnamon areas, often 10 mm. or more long, on the culms of the host. The teleutospores are uncommon and appear in the same sori as the uredospores. As the uredosori are invariably attacked by *Darluca filum* Cast., it is probable that this parasite largely prevents teleutospore-formation. I am indebted to Mr. C. C. Brittlebank, Melbourne, for specimens of this rust for comparative purposes.

10. **Puccinia obscura** Schroeter. (Fig. 30.)

Schroet.: Pass., *Nuovo. Giorn. Bot. Ital.*, vol. 9, p. 134, 1890.

Aecidium Bellidis Thuem., *Fungi Austr.*, No. 635, 1873: *hyponym. Puccinia Bellidis* Lagerh., *Bol. Soc. Broter.*, vol. 8, p. 134, 1890. *Dicaeoma obscurum* (Schroet.) Kuntze, *Rev. Gen.*, vol. 3, p. 469, 1898. *Puccinia Luzulae-maximae* Diet., *Ann. Myc.*, vol. 17, p. 57, 1919.

0. Spermogones amphigenous, numerous, scattered, honey-coloured.

I. Aecidia amphigenous, numerous, scattered. Peridia cupulate, margins erect, white, lacerate or entire. Spores polygonal, 16–22 mmm. diam.; epispore hyaline, 1–1·5 mmm. thick, moderately verruculose.

II. Uredosori hypophyllous, cinnamon-brown, scattered, elliptical, up to 1·5 mm. long, pulverulent, surrounded by the ruptured epidermis. Spores elliptical or commonly obovate, 22–30 × 18–23 mmm.; epispore coarsely and sparsely echinulate, 1·5 mmm. thick, golden-brown, with 2 equatorial germ-pores on one face.

III. Teleutosori hypophyllous, scattered, elliptical or circular, up to 1 mm. diam., pulverulent, chocolate-brown, surrounded by the ruptured epidermis. Spores clavate to elliptical, 25–40 × 15–22 mmm.; apex rounded, seldom attenuate, thickened up to 10 mmm., base attenuate, basal cell narrower than the upper, cell-contents granular, nuclei evident; constricted at the septum; epispore smooth, 1·5–2 mmm. thick, golden-brown; pedicel persistent, tinted, continuous with spore, stout, up to 25 × 8 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, conspicuous.

Host: *Luzula campestris* DC. On leaves and culms. Herb. No. 371. II, III. Kinloch (Otago), 1,120 m.; Macraes (Otago), 600 m.; Mount Judah (Otago), 900 m.; Paradise (Otago), 400 m.; *W. D. Reid!* May, Nov., Dec., 1921.

Distribution: North America; Europe.

The aecidia of this species, which have not been found in New Zealand, occur on *Bellis perennis* L. Although an aecidium is abundant on this host in New Zealand, it is that of *Puccinia distincta* McAlp., as one commonly finds the teleutospores associated with the aecidia on the same host plant. McAlpine (1906, p. 137) describes a different rust on *Luzula* spp. in Australia. This species, *Puccinia tenuispora* McAlp., differs in the delicate, thin-walled, longer and narrower teleutospores, and in the colour of both uredo- and teleuto-spores, which in his specimens are much lighter. There is a close resemblance between the two, however. I am indebted to Mr. C. C. Brittlebank, Melbourne, for specimens of *Puccinia tenuispora* McAlp. for comparative purposes.

11. Puccinia Kirkii n. sp. (Fig. 31.) Polygonaceae (4).

0, I. Unknown.

II. Uredosori amphigenous, sparingly hypophyllous, cinnamon-brown, circular, scattered, pulverulent, 0·5 mm. diam., surrounded by the ruptured epidermis. Spores elliptical or obovate, 23–29 × 19–21 mmm.; epispore sparsely and coarsely echinulate, 1–1·5 mmm. thick, pale cinnamon-brown, with 3 scattered germ-pores on one face.

III. Teleutosori associated with and indistinguishable from the uredosori. Spores broadly elliptical, 25–33 × 19–22 mmm.; apex rounded, not thickened, base rounded, rarely attenuate, both cells same size and colour; slightly constricted at the septum; epispore smooth, 1 mmm. thick, light brown, cell-contents granular; pedicel deciduous, hyaline, fragile, up to 33 × 5 mmm.; germ-pore of upper cell apical, conspicuous, basal pore two-thirds way below septum, conspicuous, both frequently papillate.

X. Mesospores uncommon, obovate, 27 × 20 mmm.; apex rounded.

Hosts:—

Rumex neglectus T. Kirk. On leaves. Herb. No. 274. II, III. Sydney Cove (Stewart Island), *T. Kirk!* 12 Feb., 1882.

Rumex flexuosus Sol. On leaves. Dunstan Mountains (Otago), *W. D. Reid!* 5 Dec., 1921. II, III. Clinton Valley (Otago), *E. H. Atkinson!* 12 Jan., 1920. (Type.)

Both hosts are endemic; *R. flexuosus* closely resembles *R. Brownii* Campd., the host of *Puccinia Ludwigii* Tepp. McAlpine (1906, p. 173) mentions *R. flexuosus* as being a host of *P. Ludwigii*; there has been some mistake in the determination of this host, as according to Cheeseman (1906, p. 591) *R. flexuosus* does not occur in Australia.

This species is named in honour of the late Mr. T. Kirk, whose works on the flora of New Zealand are so well known to students of New Zealand botany. Mr. Kirk was also keenly interested in fungi, and despatched many specimens abroad. Through the kindness of Mr. T. W. Kirk, who gave me the fungous material collected by Mr. T. Kirk, including many cotype specimens, I have been enabled to verify many of my determinations of those fungi which have been named abroad.

An occasional three-celled spore is to be seen in the teleutosori, the upper cell being divided by a vertical septum. This species is characterized by the thin non-apiculate epispore of the teleutospore.

12. **Puccinia tiritea** n. sp. (Fig. 32.)

0. Spermogones epiphyllous, in scattered more or less circular groups, seated on yellow spots, minute, immersed, honey-brown.

II. Uredosori hypophyllous, scattered or arranged in irregular groups, not confluent, circular or elliptical, minute, 0·25–0·5 mm. diam., pulverulent, cinnamon-brown, surrounded by the ruptured epidermis. Spores obovate, 25–32 × 22–28 mmm.; epispore coarsely and sparsely echinulate, 1·5–2 mmm. thick, cinnamon-brown, with 2–3 scattered germ-pores on one face.

III. Teleutosori similar to and intermixed with the uredosori, chocolate-brown. Spores broadly elliptical, 25–32 × 17–25 mmm.; apex rounded, not thickened, base rounded, seldom attenuate, both cells same size and colour; epispore coarsely warted, more prominently on the upper cell, 1·5–2 mmm. thick, chestnut-brown; pedicel decidous, hyaline, short, up to 30 × 7 mmm.; germ-pore of upper cell immediately above the septum, conspicuous, basal pore immediately below septum, conspicuous.

Hosts:—

Muehlenbeckia australis (Forst. f.) Meissn. On leaves. Herb. No. 382. II, III. Tiritea, Palmerston North (Wellington), 300 m., *G. H. C.* 3 Mar., 1921. (Type.) II, III. Kingston (Otago), 400 m., *W. D. Reid!* 22 April, 1921. Turakina (Wellington), *Mrs. M. Cunningham.* 3 Jan., 1922.

Muehlenbeckia complexa (A. Cunn.) Meissn. On leaves. Herb. Nos. 381, 396. II, III. Kingston; Table Bay; Dunstan Mountains (Otago), 300–700 m., *W. D. Reid!* April, May, 1921.

Both hosts are endemic and widely distributed throughout New Zealand (Cheeseman, 1906, p. 592). This species may readily be distinguished by the coarsely warted epispore of the teleutospore. Another peculiar feature is the position of the germ-pores, which are situated immediately above and below the septum. This is an unusual position, and does not occur in any other New Zealand species. Garrett (1910) records this peculiarity in *Puccinia poromera* Holw., a rust occurring on *Angelica dilitata* Holw., in North America. This rust is quite distinct from *P. Muehlenbeckiae* Syd., which in Australia occurs on *Muehlenbeckia adpressa* Meissn., differing chiefly in the teleutospores being coarsely warted and not thickened at the apex.

13. **Puccinia Tetragoniae** McAlpine. (Fig. 33.) Aizoaceae (5).

McAlp., *Agr. Gaz. N.S.W.*, vol. 6, p. 854, 1895.

0. Spermogones amphigenous, aggregated, numerous, honey-coloured.

I. Aecidia hypophyllous, crowded in irregular groups which are often linear. Peridia cylindrical, up to 0·5 mm. diam., margins white, lacerate, expanded. Spores globose, obovate, 27–39 × 22–25 mmm.; epispore hyaline, minutely and densely verruculose, 2 mmm. thick, cell-contents vacuolate, orange-yellow.

II. Uredosori amphigenous, circular, scattered, bullate, pulverulent, 1–1·5 mm. diam., surrounded and partially covered by the ruptured epidermis. Spores elliptical to obovate, 27–37 × 22–25 mmm.; epispore pallid yellow, 3 mmm. thick, densely and coarsely echinulate, cell-contents orange-yellow, with 4–5 scattered germ-pores on one face.

III. Teleutosori amphigenous, arranged in circinnate groups, circles attaining a diam. of 5 mm., or scattered when elliptical and up to 4 mm. long, bullate, compact, black, long covered by the epidermis. Spores elliptical or subclavate, 40–60 × 25–26 mmm.; apex rounded, seldom acuminate, thickened up to 8 mmm., or not thickened, base rounded, seldom attenuate, both cells same size and colour, lower cell sometimes slightly narrower, cell-contents granular; slightly constricted at the septum; epispore smooth, chestnut-brown, up to 5 mmm. thick; pedicel persistent, hyaline, stout, up to 35 × 8 mmm.; germ-pore of the upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores uncommon, elliptical, 35–54 × 25–29 mmm.

Host: *Tetragonia trigyna* Banks et Sol. On leaves. Herb. No. 287. II. York Bay (Wellington), *E. H. Atkinson!* 24 Jan., 1921.

Distribution: Victoria; Tasmania.

The host is endemic, although Cheeseman (1906, p. 192) states that it is probably identical with the Australian *T. implexicoma* Hook. f.

A characteristic feature of this species is the large size, and the greatly thickened epispore of the teleutospores. I am indebted to Mr. C. C. Brittlebank for specimens of this rust for comparative purposes.

14. **Puccinia clavata** Sydow. (Text-fig. 34, and Plate 77, fig. 5.) Ranunculaceae (6).

Syd., *Mon. Ured.*, vol. I, p. 428, 1904.

0. Spermogones amphigenous, scattered, seated on yellow spots, surrounded by the aecidia, honey-yellow.

I. Aecidia hypophyllous, aggregated on more or less orbicular yellow spots up to 3 mm. in diam., circinnately arranged, pallid yellow. Peridia up to 450 mmm. diam., tubular, erumpent, standing above leaf-surface 500–600 mmm., margins slightly expanded, dentate. Spores subglobose or polygonal, 20–27 × 18–22 mmm.; epispore minutely and closely verruculose, tinted, 1·5 mmm. thick, cell-contents granular, pallid yellow, 2–4 scattered germ-pores on one face.

II. Uredosori hypophyllous, lemon-yellow, elliptical, up to 1 mm. long, scattered, pulverulent, exposed by the longitudinal fissuring of the epidermis. Spores subglobose, elliptical, or obovate, 20–28 × 12–20 mmm.; epispore densely and coarsely verruculose, cream-coloured, 2·5–3 mmm. thick, hyaline, with 7–10 scattered germ-pores on one face.

III. Teleutosori hypophyllous, on small discoloured spots which are visible on the upper surface, black, circular, scattered, pulvinate, compact,

up to 2 mm. diam., long covered. Spores clavate, 45–62 × 12–22 mmm.; apex acuminate, rounded, or truncate, thickened up to 12 mmm., darker in colour than the rest of the spore, base attenuate, basal cell longer, narrower, and lighter in colour than upper; constricted at the septum; epispore smooth, pallid brown, 2·5–3 mmm. thick in apical cell, 1·5–2 mmm. in basal, cell-contents vacuolate; pedicel persistent, coloured, short, up to 21 × 7 mmm.; germ-pore of the upper cell apical, obscure, basal pore immediately below septum, obscure.

Hosts:—

Clematis foetida Raoul. On leaves. Herb. No. 269. III. Weraroa; Lake Papaetonga, Levin (Wellington), *E. H. Atkinson!* Sept., Nov., 1919.

Clematis hexasepala DC. On leaves. I. Levin (Wellington), *E. H. Atkinson!* 12 Feb., 1919. III. No locality given. *Bastian* (Syd.).

Clematis indivisa Willd. On leaves of juvenile plants. I, II. Sandhills, Levin (Wellington), *E. H. Atkinson!* 13 Nov., 1919. II. Motupiko River (Nelson), 500 m., *H. H. Allan!* 5 Jan., 1921.

The hosts are endemic, and distributed over both Islands (Cheeseman, 1906, pp. 2–4). In his original description, Sydow describes the teleutostage alone; but as all three stages occur on the same genus of host plant, and as more than one stage has been collected on the same species, and all three stages in or near the same locality, I have grouped all three under the one species. The teleutospores are very irregular in shape, and one commonly finds the pedicel laterally inserted.

But one other rust occurs on indigenous species of *Clematis* in New Zealand—namely, *Aecidium otagense* Lindsay. This differs mainly in the larger size of the aecidia, and in its habit of forming large, inflated, and distorted areas on the host (Plate 77, fig. 2).

15. Puccinia contegens n. sp. (Fig. 35.)

0. Spermogones amphigenous, sparse, associated with the aecidia, honey-coloured.

I. Aecidia hypophyllous, in crowded groups, yellow. Peridia immersed, margins incurved and partially covered with the epidermis, opening by an irregular pore. Spores polygonal or elliptical, 17–26 × 15–18 mmm.; epispore hyaline, 2 mmm. thick, densely and minutely verruculose, cell-contents orange, vacuolate.

III. Teleutosori amphigenous, chestnut-brown, pulverulent, at first scattered, circular, and surrounded by the ruptured epidermis, becoming confluent, frequently the entire under-surface of the leaf becoming covered. Spores elliptical or subclavate, 30–45 × 16–23 mmm.; apex rounded, sometimes obliquely acuminate, not thickened, base rounded, less frequently attenuate, both cells same size and colour; slightly or not constricted at the septum; epispore 1–1·5 mmm. thick, reticulate, more prominently on the upper cell, chestnut-brown, cell-contents vacuolate; pedicel persistent, hyaline, fragile, up to 60 × 7 mmm., sometimes laterally attached; germ-pore of upper cell apical, conspicuous, basal pore two-thirds below septum, conspicuous, both frequently papillate.

X. Mesospores uncommon, obovate or subglobose, averaging 22 × 18 mmm.; epispore reticulate, 1 mmm. thick, chestnut-brown.

Hosts:—

Ranunculus lappaceus Smith. On leaves. Herb. No. 284. III. Glen Wye, Hanmer (Canterbury), *W. D. Reid!* 26 Oct., 1919. Mount Judah (Otago), 500 m., *W. D. Reid!* 14 Dec., 1921.

Ranunculus multiscapus Hook. f. On leaves. III. Burke's Pass (Canterbury), *W. D. Reid!* 18 Nov., 1919. I, III. Macraes (Otago), *W. D. Reid!* 28 Nov., 1921. (Type.) Mount Torlesse (Canterbury), *W. D. Reid!* Feb., 1921. III. Mount Judah (Otago), 800 m., *W. D. Reid!* 25 Dec., 1921.

Both the hosts are indigenous; *R. lappaceus* occurs also in Australia (Cheeseman, 1906, p. 20). About 5 per cent. of small spores are present in the teleutosori; these are similar to the normal spores save in size, which is considerably less than normal, being on the average 25 × 15 mmm. (fig. 35, No. 5). Occasionally a vertical septum is present in the upper cell. Characterized by the non-thickened apex, and reticulate epispore of the teleutospore.

16. **Puccinia inornata** n. sp. (Fig. 36.) Cruciferae (7).

0. Unknown.

III. Teleutosori amphigenous and caulicolous, circular or elliptical, scattered, becoming confluent, up to 1·5 mm. long, cinnamon-brown, pulverulent, surrounded by the ruptured epidermis, causing the hosts to become distorted and stunted. Spores elliptical, 23–35 × 12–16 mmm.; apex rounded or bluntly acuminate, not thickened, base rounded, both cells same size or the lower often somewhat narrower; constricted at the septum; epispore minutely warted, 1·5–2 mmm. thick, pallid brown; pedicel deciduous, hyaline sometimes tinted, short, up to 20 × 5 mmm.; germ-pore of upper cell apical, conspicuous, frequently papillate, basal pore immediately above pedicel, conspicuous.

Host: *Cardamine heterophylla* (Forst. f.) O. E. Schulz. On leaves, petioles, and stems. Herb. No. 444. III. Macraes (Otago), 600 m., *W. D. Reid!* 29 Nov., 1921. (Type.)

This rust is very conspicuous, as it distorts and stunts the host; where infection is severe the plant appears as if covered with a cinnamon-brown powder. The host is indigenous and widespread; it appears to be common in other countries. This rust is characterized by the distorting habit and by the warted epispore. Another constant feature is the position of the basal germ-pore, which is situated immediately above the pedicel.

17. **Puccinia Reidii** n. sp. (Fig. 37.)

0. Spermogones amphigenous, preceding sori, on discoloured spots, scattered, or in sparse groups, immersed, honey-yellow.

III. Teleutosori amphigenous and caulicolous, elliptical, scattered, up to 1 cm. long, bullate, pulverulent, black, long covered, finally becoming exposed by the longitudinal fissuring of the epidermis. Spores elliptic-oblong, 32–42 × 15–22 mmm.; apex rounded, rarely acuminate, not thickened, base rounded, both cells same size and colour, cell-contents granular; constricted at the septum; epispore chestnut-brown, 3 mmm. thick, markedly longitudinally striate, striae converging at the poles; pedicel deciduous, hyaline, up to 45 × 6 mmm.; germ-pore of the upper cell apical, or sometimes one-fourth way down side, conspicuous, basal pore immediately below septum, conspicuous, both usually papillate.

Host: *Radicula* sp. ined. On leaves, petioles, and stems. Herb. No. 378. III. Walter Peak (Otago), *W. D. Reid!* 27 April, 1921. (Type.)

The host, together with the rust, was collected by Dr. Cockayne and his assistant, Mr. W. D. Reid. The host proved to be an undescribed

species; it appears to be rare, and confined to the one locality. The rust is named in honour of Mr. Reid, who has collected the major number of the specimens in my herbarium. Mr. Reid has had excellent opportunities for collecting; as assistant to Dr. Cockayne he has traversed practically the whole mountain-chain of the South Island, and has never failed to send interesting material, excellently preserved, from the localities visited. Moreover, all host plants forwarded have been determined by Dr. Cockayne, so that I have been fortunate in having all the host plants collected by Mr. Reid correctly named.

This species is characterized by the thick longitudinally-striate epispore of the teleutospore.

18. Puccinia Pruni-spinosae Persoon. (Text-fig. 38, and Plate 77, fig, 6.)

Rosaceae (8).

Pers., *Syn. Fungi*, p. 226, 1801.

Aecidium punctatum Pers., *Ann. Bot. Usteri*, vol. 20, p. 135, 1796. *Puccinia Pruni* DC., *Fl. Fr.*, vol. 2, p. 222, 1805. *Aecidium quadrifidum* DC., in Poir., *Encycl. Meth. Bot.*, vol. 8, p. 235, 1808. *Puccinia Prunorum* Link., in Willd., *Sp. Pl.*, vol. 6, p. 82, 1825. *Uredo fusiformis* Gachet, *Act. Soc. Linn. Bordeaux*, vol. 5, p. 232, 1832. *Aecidium hepaticum* Schw., *Trans. Am. Phil. Soc.*, ser. 2, vol. 4, p. 293, 1832. *Uredo Pruni* Cast., *Obs. Myc.*, vol. 1, p. 27, 1842. *Uromyces Prunorum* Fcl., *Jahrb. Ver. Nat. Nass.*, vol. 15, p. 20, 1861. *Dicaeoma Prunorum* Rabh., *Fungi Eur.*, No. 990, 1866. *Puccinia discolor* Fcl., *Symb. Myc.*, No. 50, 1869. *Dicaeoma Pruni-spinosae* Kuntze, *Rev. Gen. Pl.*, vol. 3, p. 470, 1898. *Aecidium dakotensis* Griff., *Bull. Torr. Cl.*, vol. 29, p. 300, 1902. *A. Aikeni* Syd., *Ann. Myc.*, vol. 1, p. 334, 1903. *Tranzschelia punctata* (Pers.) Arth., *Res. Sci. Congr. Bot. Vienne*, p. 340, 1906.

0. Spermogones amphigenous, scattered, conspicuous, honey-coloured.

I. Aecidia hypophyllous, scattered. Peridia at first cylindrical, dehiscing into 3–5 lobes which lie parallel with the leaf-surface, margin broad, revolute, or more commonly flat. Spores subglobose, 18–26 × 15–23 mmm.; epispore closely and minutely verruculose, 1·5–2 mmm. thick, cinnamon-brown.

II. Uredosori hypophyllous, grouped on scattered yellow spots which are visible on the upper surface, cinnamon-brown, circular, pulverulent, up to 0·5 mm. diam., surrounded by the ruptured epidermis. Spores somewhat bluntly fusiform, 25–38 × 12–18 mmm.; epispore sparsely and coarsely verrucose, more prominently below, 1·5 mmm. thick, apex thickened up to 9 mmm. and bluntly acuminate, with 2–3 equatorial germ-pores on one face; intermixed with numerous capitate pale-yellow paraphyses, which may reach a size of 60 × 16 mmm.

III. Teleutosori hypophyllous, dark chestnut-brown, circular, scattered, pulverulent, up to 1 mm. diam., surrounded by the ruptured epidermis. Spores oblong, elliptical, or somewhat obovate, 30–40 × 18–26 mmm., apex rounded, thickened up to 6 mmm., seldom not thickened, base rounded, basal cell usually narrower and lighter in colour than the upper, both semiglobose and readily separable; deeply constricted at the septum; epispore closely and coarsely verrucose, 1·5–2 mmm. thick, thinner in lower cell, chestnut-brown; pedicel deciduous, hyaline, fragile; germ-pore of upper cell apical, obscure, basal pore one-third way below septum, obscure, frequently papillate.

Hosts:—

Anemone sp. cult. On leaves. Herb. No. 437. I. Christchurch (Canterbury), *W. K. Dallas!* 27 Nov., 1921.

Prunus amygdalus Stokes. On leaves. Herb. No. 183. II. Clyde (Otago), *G. H. C.* 7 Nov., 1919.

Prunus armeniaca L. On leaves. II. Cromwell (Otago), *G. H. C.* 5 Nov., 1919.

Prunus domestica L. On leaves. II, III. Palmerston North (Wellington), *G. H. C.* 18 June, 1919.

Prunus persica Stokes. On leaves. II. Weraroa (Wellington), *G. H. C.* 21 May, 1919.

Distribution: Australia; North and South America; Europe; Africa.

This is an heteroecious species, the aecidia occurring on *Anemone* spp.; this connection was first worked out by Tranzschel (1904). The mycelium of the aecidia is perennial, and infected leaves are somewhat paler in colour and frequently much distorted. From the aecidia, spores are produced which infect the leaves of peaches, plums, &c., growing in the vicinity. On these leaves uredospores are produced, followed later in the season by teleutospores. As viable uredospores are to be obtained nine months of the year, it is probable that this rust is spread chiefly by these spores. This will appear more evident when one considers the fact that the aecidial host is an introduced species and is found in but a few localities; yet this rust is prevalent throughout New Zealand on stone-fruits. McAlpine (1902, p. 23) describes and figures this fungus attacking the fruit and cortex of a peach-tree. On the bark large irregular cankered areas were formed, and sori of the rust were found deeply embedded in the mesocarp of the fruits.

When the teleutosori are examined under a low power the spores are seen to be aggregated together in globose masses; higher magnification shows that the pedicels of the spores are firmly agglutinated together. McAlpine appears to have been the first to record this peculiarity (1904, p. 348), and it forms one of the characters on which Arthur (1907, p. 150) erected the genus *Tranzschelia*.

Characterized by the fusoid, verrucose uredospores, and strongly warted teleutospores. The grouping of the spores in globose masses is another feature peculiar to this species.

19. Puccinia granularis Kalchbrenner and Cooke. (Text-fig. 40, and Plate 77, fig. 7.) Geraniaceae. (9).

Kalch. et Cke., *Grev.*, vol. 11, p. 22, 1883.

0, I. Unknown.

II. Uredosori amphigenous and sparingly caulicolous, at first scattered, minute, circular, becoming confluent and somewhat circinnate, up to 3 mm. diam., pulverulent, chestnut-brown, surrounded by the ruptured epidermis. Spores globose to obovate, 21–28 × 18–24 mmm.; epispore sparsely and somewhat finely echinulate, 2–2·5 mmm. thick, thickened at base to 3 mmm., cinnamon-brown, with 2 germ-spores on one face.

III. Teleutosori hypophyllous, surrounding uredosori, chocolate-brown, bullate, compact, circinnate, circles may attain a diam. of 3 cm., long covered. Spores elongate-elliptical, oblong, or clavate, 37–48 × 19–23 mmm.; apex bluntly rounded, truncate, often oblique, slightly (4 mmm.) or not thickened, base attenuate, frequently rounded; constricted at the septum; epispore smooth, 2·5–3 mmm. thick, chestnut-brown, darker above; pedicel persistent, fragile, short, up to 50 × 8 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

Host: *Pelargonium zonale* L'Herit. On leaves, petioles, and stems. Herb. No. 283. II. Palmerston North (Wellington), *G. H. C.* 4 June, 1919.

II, III. York Bay (Wellington), *E. H. Atkinson!* 1 Feb., 1921. Napier (Hawke's Bay), *J. Anderson!* 12 Nov., 1921.

Distribution: South Africa; Australia.

Common on cultivated pelargoniums throughout New Zealand. Recognized by the marked circinnate grouping of the teleutosori (see Plate 77, fig. 7), and scarcely thickened apex and smooth epispore of the teleutospores. *Puccinia Pelargonii* Syd. is separated from this species solely on account of the presence of aecidia in the cycle. In all other respects it appears to be identical. I am indebted to Dr. E. W. Mason, of the Imperial Bureau of Mycology, Kew, for the correct determination of this species.

20. Puccinia Morrisoni McAlpine. (Fig. 39.)

McAlp., *Rusts Aus.*, p. 180, 1906.

0. Unknown.

I. Aecidia amphigenous, either alone or accompanied by teleutospores, delicate, circinnate, orange, minute. Peridia with expanded and lobed margins. Spores elliptical to subquadrate, 19–22 × 16 mmm.; epispore finely echinulate.

II. Uredosori amphigenous, cinnamon-brown, circular, scattered or arranged in confluent groups, pulverulent, up to 1 mm. diam., surrounded by the ruptured epidermis. Spores subglobose or elliptical, 22–28 × 15–22 mmm.; epispore sparsely and somewhat coarsely echinulate, 2 mmm. thick, golden-brown, with 2 germ-pores on one face.

III. Teleutosori amphigenous and caulicolous, chocolate-brown, circular, on stems elliptical, scattered, or arranged in confluent groups, pulvinate, compact, up to 2 mm. diam., surrounded by the ruptured epidermis. Spores clavate, 36–68 × 18–25 mmm.; apex acuminate, truncate, or often oblique, thickened up to 10 mmm., darker in colour, base attenuate, basal cell longer, narrower, and lighter in colour than upper; constricted at the septum; epispore smooth, 2–2·5 mmm. thick in upper cell, 1–1·5 mmm. in lower, chestnut-brown, cell-contents granular, nuclei evident; pedicel persistent, tinted, darker in colour at apex, stout, up to 38 × 9 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, obscure, occasionally papillate.

X. Mesospores common, elliptical, 32–36 × 17–20 mmm.; apex rounded, truncate, or acuminate, thickened.

Host: *Pelargonium inodorum* Willd. On leaves and stems. Herb. No. 272. II, III. Cluny, Turakina (Wellington), *G. H. C.* 25 Dec., 1920. II, III. Seashore near Pencarrow (Wellington), *E. H. Atkinson!* 10 Feb., 1921.

Distribution: Australia; Tasmania.

The host is indigenous, and occurs also in Australia, Tasmania, and Tristan d'Acunha. Cheeseman (1906, p. 91) states that it is probably identical with *P. grossularioides* Ait., a South African species. So far the aecidial stage has not been collected in New Zealand. This species differs from the preceding in the possession of a larger teleutospore, more thickened at the apex.

21. Puccinia Plagianthi McAlpine. (Plate 77, fig. 8.) Malvaceae (10).

McAlp., *Proc. Roy. Soc. Vic.*, vol. 7 (n.s.), p. 218, 1894.

0. Spermogones amphigenous, in scattered groups on yellow spots, erumpent, honey-coloured.

III. Teleutosori amphigenous, chiefly hypophyllous, seated on yellow spots, circular, pulverulent, chestnut-brown, minute, scattered, up to 0·5 mm. diam., surrounded by the ruptured epidermis. Spores elliptical, seldom subclavate, 33–45 × 15–21 mmm.; apex rounded, not or slightly thickened, base subattenuate or rounded, both cells same size and colour; constricted at the septum; epispore finely reticulate, 1·5–2 mmm. thick, golden-brown, cell-contents vacuolate; pedicel deciduous, hyaline, short, up to 60 × 7 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately above the pedicel, conspicuous.

Hosts:—

Gaya Lyallii (Hook. f.) J. E. Baker. On leaves. Herb. No. 280. III. Clinton Valley (Otago), *E. H. Atkinson!* 19 Jan., 1920.

Plagianthus betulinus A. Cunn. On leaves and inflorescences. Herb. No. 290. III. Masterton (Wellington), *G. H. C.* 14 Jan., 1919. Upper Hutt (Wellington), *E. H. Atkinson!* 23 Jan., 1921. Palmerston North (Wellington), *G. H. C.* 3 Mar., 1921.

Distribution: Tasmania.

Both hosts are endemic, *Gaya Lyallii* being confined to the South Island (Cheeseman, 1906, pp. 77–80). Distinguished by the elliptical teleutospores with their reticulate episporeS. *P. Hoheriae* is separated from this species on account of the differences in sorus characters.

22. **Puccinia Hoheriae** n. sp. (Text-fig. 41, and Plate 77, fig. 9.)

0. Spermogones epiphyllous, sparse, in scattered groups on pallid spots, minute, immersed, honey-coloured.

III. Teleutosori amphigenous, chiefly hypophyllous, and caulicolous, on leaves scattered, when elliptical, seated on purple spots, but more frequently aggregated into irregular masses up to 40 mm. long, forming distorted areas which on the opposite surface are ashy-grey and surrounded by broad purple margins, on stems forming large, irregular, distorted and inflated areas which may attain a length of 50 mm., dark chestnut-brown, pulverulent.

Teleutospores as in *P. Plagianthi.*

Host: *Hoheria populnea* A. Cunn. On leaves, petioles, and shoots. Herb. Nos. 182, 423. III. Karori (Wellington), *R. Waters!* 8 Dec., 1920. (Type.) Palmerston North (Wellington), *J. W. Whelan!* 7 Sept., 1921. Manawatu Gorge (Wellington), *J. W. Whelan!* 2 Nov., 1921.

The host is endemic and widespread. It is with considerable hesitation that I have raised this well-marked form to specific rank, as it differs from *P. Plagianthi* only in sorus characters; these, however, are so well marked that to the eye there appears to be no resemblance whatever between the two. It is only when the teleutospores are examined under the microscope that the relationship of the two forms becomes apparent. (See Plate 77, figs. 8, 9.)

23. Puccinia Malvacearum Bertero. (Fig. 42.)

Bert., in C. Gay, *Fl. Chile*, vol. 8, p. 43, 1852.

0. Unknown.

III. Teleutosori amphigenous, chiefly hypophyllous, and caulicolous, seated on discoloured spots, on leaves circular, on stems elliptical, scattered, cinnamon-brown, pulvinate, compact, up to 1·5 mm. diam., at first covered, soon naked. Spores fusiform, 40–90 × 14–24 mmm.; apex

bluntly acuminate, seldom rounded, thickened up to 10 mmm., base attenuate, both cells same size and colour; slightly constricted at the septum; epispore smooth, 2–3 mmm. thick, pallid brown, cell-contents vacuolate; pedicel persistent, hyaline, long, stout, up to 160 × 10 mmm., continuous with spore; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, conspicuous, frequently papillate.

X. Mesospores rare, fusiform, 30–45 × 17–19 mmm.; apex thickened.

Hosts:—

Althaea rosea (L.) Cav. On leaves, petioles, and stems. Herb. No. 23. III. Turakina (Wellington), *G. H. C.* 5 July, 1919. Napier (Hawke's Bay), *H. Hill!* 5 Sept., 1921.

Malva rotundifolia L. On leaves and petioles. III. Willis Street, Wellington, *T. Kirk!* 1880.

Malva sylvestris L. On leaves. III. Botanical Gardens, Dunedin, *T. Kirk!* 30 Dec., 1884.

Distribution: Australia; North and South America; Europe; Asia.

All the hosts are introduced. The sori and spores vary considerably in size on different hosts. McAlpine (1906, p. 179) states that he has occasionally found a septate pedicel. The teleutospore germinates immediately on reaching maturity; it would appear that a few are capable of remaining viable throughout the winter, however, giving rise to fresh infection in the spring.

Characterized by the smooth, fusiform teleutospores.

24. **Puccinia Hederaceae** McAlpine. (Fig. 43.) Violaceae (11).

McAlp., *Rusts Aus.*, p. 183, 1906.

0. Spermogones amphigenous, crowded in small or large groups, honey-coloured.

I. Aecidia amphigenous, and on petals and flowers, in crowded groups, or seldom scattered. Peridia cupulate, 0·5 mm. diam., immersed, margins

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Fig. 42.—*Puccinia Malvacearum* Bert. Teleutospores from *Althaea rosea* Cav.

Fig. 43.—*Puccinia Hederaceae* McAlp. Uredo- and teleuto-spores from *Viola Cunninghamii* Hook. f. No. 6 shows a vertical septum.

Fig. 44.—*Puccinia Halorrhagidis* sp. nov. Uredo- and teleuto-spores from *Halorrhagis erecta* (Murr.) Schindler. No. 4 is three-celled.

Fig. 45.—*Puccinia pulverulenta* Grev. Uredo- and teleuto-spores from *Epilobium novae-zelandiae* Hausskn.

Fig. 46.—*Puccinia cuniculi* sp. nov. Uredo- and teleuto-spores from *Angelica Gingidium* Hook. f.

Fig. 47.—*Puccinia Hydrocotyles* Cke. Uredo- and teleuto-spores from *Hydrocotyle novae-zelandiae* DC. and *H. moschata* Forst. f. Nos. 4 and 5 are from the latter host.

Fig. 48.—*Puccinia kopoti* sp. nov. Uredo- and teleuto-spores from *Anisotome aromatica* Hook. f.

Fig. 49.—*Puccinia Oreomyrrhidis* sp. nov. Teleutospores from *Oreomyrrhis andicola* Endl. No. 4 is a small form of which there is about 1 per cent. present in a sorus.

Fig. 50.—*Puccinia Thuemeni* McAlp. Uredo- and teleuto-spores from *Apium prostratum* (DC.) Lab.

Fig. 51.—*Puccinia Cockaynei* sp. nov. Teleutospores from *Gentiana corymbifera* T. Kirk.

Fig. 52.—*Puccinia tararua* sp. nov. Uredo- and teleuto-spores from *Gentiana patula* Cheesem.

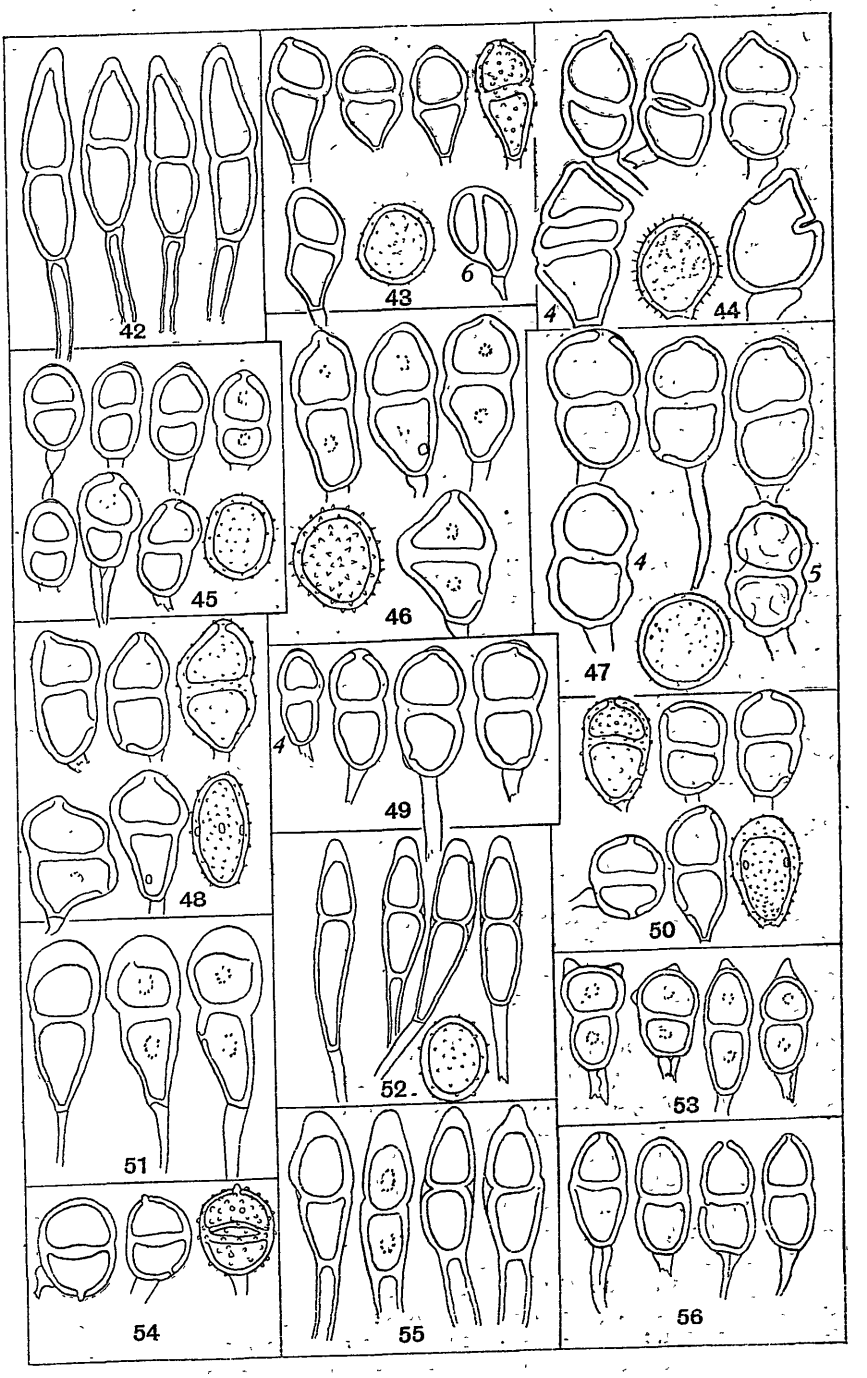
Fig. 53.—*Puccinia Dichondrae* Mont. Teleutospores from *Dichondra repens* Forst. f.

Fig. 54.—*Puccinia Menthae* Pers. Teleutospores from *Mentha Cunninghamii* Benth.

Fig. 55.—*Puccinia pedatissima* sp. nov. Teleutospores from *Ourisia macrophylla* Hook. Note persistent pedicels.

Fig. 56.—*Puccinia Coprosmae* Cke. Teleutospores from *Coprosma lucida* Forst. f.

Camera-lucida drawings by author. All × 500. *m* = mesospore.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alone showing, shortly revolute, lacerate, white. Spores subglobose to shortly elliptical, 16–19 × 12–14 mmm.; epispore finely and densely verruculose, 1·5–2 mmm. thick, hyaline, cell-contents orange-yellow.

II. Uredosori amphigenous and caulicolous, chestnut-brown, scattered, pulverulent, circular or elliptical, up to 1 mm. diam., surrounded by the ruptured epidermis. Spores subglobose, frequently elliptical, 22–27 × 18–22 mmm.; epispore coarsely and sparsely echinulate, 2–2·5 mmm. thick, cinnamon-brown, with 2–3 scattered germ-pores on one face.

III. Teleutosori amphigenous and caulicolous, dark chestnut-brown, circular, scattered, pulverulent, up to 0·5 mm. diam., surrounded by the ruptured epidermis. Spores subclavate, frequently elliptical, 25–45 × 17–26 mmm.; apex rounded, frequently somewhat acuminate, slightly thickened, up to 5 mmm., base attenuate, basal cell slightly narrower and lighter in colour than upper, cell-contents vacuolate; slightly constricted at the septum; epispore minutely but prominently warted, warts more prominent on the upper cell, chestnut-brown, 1–2 mmm. thick; pedicel deciduous, hyaline, up to 30 × 5 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below the septum, conspicuous, both usually papillate.

X. Mesospores uncommon, elliptical, 22–26 × 29 mmm.; apex rounded, thickened.

Host: *Viola Cunninghamii* Hook. f. On leaves, petioles, and peduncles. Herb. No. 21. I, II, III. Loburn (Otago), 300 m., *W. D. Reid!* 4 Dec., 1921. II, III. Brightwater (Canterbury), *W. H. Bryant!* 25 May, 1911. Mount Torlesse (Canterbury), *W. D. Reid!* 10 Feb., 1921. Mount Pisa; Ben Lomond (Otago), *W. D. Reid!* Mar., 1921.

Distribution: Australia; Tasmania.

The host is indigenous and widespread; it occurs also in Tasmania (Cheeseman, 1906, p. 45). This species is distinguished by the warted teleutospores.

25. **Puccinia Halorrhagidis** n. sp. (Fig. 44.) Halorrhagaceae (12).

0. Spermogones epiphyllous and caulicolous, scattered, sparse, immersed, honey-coloured.

I. Aecidia hypophyllous, scattered over leaf-surface. Peridia cupulate, margins erumpent, somewhat incurved, lacerate, tinted orange. Spores globose or subglobose, 18–22 mmm. diam.; epispore finely and closely verruculose, hyaline, 1 mmm. thick, cell-contents reddish-orange.

II. Uredosori amphigenous, chiefly epiphyllous, scattered, circular, up to 1 mm. diam., bullate, pulverulent, cinnamon-brown, surrounded and partially covered by the ruptured epidermis. Spores globose or subglobose, 20–25 mmm. diam.; epispore evenly and sparsely aculeate, 2 mmm. thick, cinnamon-brown, with 2–3 equatorial germ-pores on one face.

III. Teleutosori mixed with uredosori, amphigenous and caulicolous, bullate, scattered, or frequently circinnately arranged, circular or elliptical, up to 1·5 mm. diam., chestnut-brown, long covered. Spores elliptical or elongate-oblong, frequently irregular and distorted, 28–42 × 17–27 mmm.; apex rounded, seldom acuminate, not thickened, base rounded, lower cell usually larger than upper; constricted at the septum; epispore smooth, 1·5–2·5 mmm. thick, pale chestnut-brown; pedicel deciduous, hyaline, up to 35 × 8 mmm.; germ-pore of the upper cell usually apical, sometimes one-third way down side, conspicuous, basal pore from immediately below septum to two-thirds way down side, conspicuous, both frequently papillate.

X. Mesospores common, obovate; apex acuminate, often truncate.

Hosts :—

Halorrhagis depressa (A. Cunn.) Walp. On leaves and stems. Herb. No. 414. I, II, III. Cass (Canterbury), 600 m., *W. D. Reid! N. R. Foy!* 22 Jan., 1922.

Halorrhagis erecta (Murr.) Schindler. I, II, III. Seashore, Seatoun (Wellington), *E. H. Atkinson! G. H. C.* 10 Feb., 1921. (Type.)

Both hosts are indigenous and widespread; they occur also in Australia, and *H. erecta* extends to the island of Juan Fernandez (Cheeseman, 1906, p. 148).

The teleutospores are very irregular in shape, three- and four-celled not uncommon. Characterized by the rounded, non-thickened apex, smooth epispore, and distorted teleutospores.

26. Puccinia pulverulenta Greville. (Fig. 45.) Onagraceae (13).

Grev., *Fl. Edin.*, p. 432, 1824.

Uredo vagans var. *Epilobii-tetragonii* DC., *Fl. Fr.*, vol. 2, p. 228, 1805. *Aecidium Epilobii* DC., *l.c.*, p. 238. *Uredo Epilobii* DC., *Fl. Fr.*, vol. 6, p. 73, 1815. *Caeoma Epilobii* Link., in Willd., *Sp. Pl.*, vol. 6, p. 59, 1825. *Trichobasis Epilobii* Berk.: Cke., *Micr. Fungi*, p. 210, 1865. *Puccinia Gayophyti* Billings, in S. Watson's *Bot. King's Expl.*, p. 414, 1871. *P. Oenotherae* Vize, *Grev.*, vol. 5, p. 109, 1877. *Aecidium Gayophyti* Vize, *Grev.*, vol. 7, p. 12, 1878. *Puccinia Epilobii-tetragonii* Wint., in Rab., *Krypt. Fl.*, vol. 1, p. 214, 1881. *P. Boisduvaliae* Peck, *Bot. Gaz.*, vol. 7, p. 45, 1882. *P. Gayophyti* Peck, *l.c.*, p. 56. *P. Clarkiae* Peck, *Bull. Torr. Club*, vol. 11, p. 49, 1884. *P. Epilobii* Schroet., *Krypt. Fl. Schles.*, vol. 1, p. 319, 1887. *P. intermedia* Diet. et Holw.: Diet., in *Bot. Gaz.*, vol. 18, p. 254, 1893. *P. Heterantha* Ell. et Ev., *Erythea*, vol. 1, p. 204, 1893. *P. Eulobi* Diet. et Holw.: Diet., *l.c.*, p. 249. *Aecidium Clarkiae* Diet. et Holw.: Diet., in *Erythea*, vol. 2, p. 129, 1894. *Puccinia Sphaerostigmatis* Diet. et Negr., *Bot. Jahrb.*, vol. 22, p. 353, 1896. *Dicaeoma Boisduvaliae* Kuntze, *Rev. Gen.*, vol. 3, p. 468, 1898. *D. Clarkiae* Kuntze, *l.c.* *D. Gayophyti* Kuntze, *l.c.* *D. heteranthum* Kuntze, *l.c.*, p. 469. *D. intermedium* Kuntze, *l.c.* *D. Oenotherae* Kuntze, *l.c.* *Puccinia Gayophyti* Speg., *Anal. Mus. Nac. Buenos Aires*, ser. 3, vol. 1, p. 63, 1902. *P. Zauschneriae* Syd., *Mon. Ured.*, vol. 1, p. 435, 1903. *P. glabella* Holway, *N. Am. Ured.*, vol. 1, p. 76, 1907. *Dicaeoma Epilobii-tetragoni* (DC.) Arth., *N. Am. Fl.*, vol. 7, p. 394, 1920.

0. Spermogones amphigenous, scattered, associated with the aecidia, honey-coloured.

I. Aecidia amphigenous, scattered or crowded, covering entire leaf-surfaces, also stems and capsules. Peridia cupulate, up to 250 mmm. diam., margins white, revolute, lacerate. Spores polygonal, 15–26 mmm. diam.; epispore finely and densely verruculose, 1 mmm. thick, hyaline, spore-contents orange-yellow.

II. Uredosori amphigenous, cinnamon-brown, circular, up to 1 mm. diam., scattered or sometimes arranged in irregular circinnate groups, pulverulent, surrounded by the ruptured epidermis. Spores subglobose, elliptical, or obovate, 21–27 × 15–24 mmm.; epispore sparsely and somewhat coarsely echinulate, up to 3 mmm. thick, cinnamon-brown, with 2 usually papillate, equatorial germ-pores on one face.

III. Teleutosori hypophyllous, dark brown, circular, frequently circinnate, scattered, pulverulent, up to 1 mm. diam., surrounded by the ruptured epidermis. Spores elliptical, or elongate clavate, 24–34 × 16–22 mmm.; apex rounded, thickened up to 5 mmm., base rounded, frequently attenuate, basal cell somewhat narrower and lighter in colour than the upper; constricted at the septum; epispore smooth, 2·5–3 mmm. thick, cinnamon-brown, cell-contents vacuolate; pedicel hyaline, deciduous, fragile, up to

50 × 6 mmm.; germ-pore of upper cell apical, or frequently one-third way down one side, conspicuous, basal pore from one-third to two-thirds way down side, obscure.

X. Mesospores rare, subclavate, 21–27 × 13–17 mmm.; thickened and rounded at apex.

Hosts:—

Epilobium chloraefolium Hausskn. On leaves. I. Mount Peel (Canterbury), 1,400 m., *H. H. Allan!* 25 Oct., 1921.

Epilobium confertifolium Hook f. On leaves. Herb. No. 179. I. Enderby Island, *L. Cockayne!* 25 May, 1911.

Epilobium glabellum Forst. f. On leaves. Herb. No. 358. II, III. Walter Peak (Otago), 400 m., *W. D. Reid!* 27 April, 1921.

Epilobium Hectori Hausskn. On leaves. Herb. No. 179. I. Alexandra (Otago), *G. H. C.* 10 Dec., 1921. II, III. Glenorchy (Otago), 400 m., *W. D. Reid!* 11 Dec., 1921.

Epilobium melanocaulon Hook. On leaves. Herb. No. 357. II, III. Walter Peak (Otago), 440 m.; Kinloch (Otago), 1,300 m., *W. D. Reid.* April, May, 1921.

Epilobium microphyllum A. Rich. Herb. Nos. 359, 429. II, III. Greenstone River bed (Otago), *W. D. Reid!* 6 April, 1921. I, II, III. River-bed, Grantham, Hanmer (Canterbury), *W. D. Reid!* 10 Nov., 1921.

Epilobium novae-zelandiae Hausskn. On leaves. Herb. No. 356. II, III. Ben Lomond Spur; Tooth Peaks (Otago). I, II, III. Paradise (Otago), 400–1,000 m., *W. D. Reid!* Mar,. April, Dec., 1921.

Epilobium nummularifolium R. Cunn. I. South Karori (Wellington), *T. Kirk!* 7 Nov., 1883.

Epilobium tasmanicum Hausskn. Herb. No. 356. I, II, III. Mount Pisa, 1,160 m.; Macraes (Otago), *W. D. Reid!* Mar., Nov., 1921.

Epilobium sp. I, II, III. Mount Egmont (Taranaki), *E. Bruce Levy!* Feb., 1918.

Distribution: Australia; North and South America; Europe; Asia.

All the hosts are endemic: some are apparently widely distributed over both Islands; others appear to be confined to a few localities (Cheeseman, 1906, pp. 175–85).

One commonly finds all three spore-forms on the same host plant. Plants infected with the aecidial stage become somewhat distorted and paler in colour than normal.

Although this species differs somewhat in sorus characters from the European forms, I find that on comparison the teleutospores are identical.

27. Puccinia cuniculi n. sp. (Fig. 46.) Umbelliferae (14).

0. Spermogones amphigenous, associated with the aecidia, sparse, scattered, minute, honey-coloured.

I. Aecidia hypophyllous and caulicolous, closely aggregated, on leaves arranged concentrically on somewhat inflated areas, forming discoloured spots which are visible on the upper surface, on stems and petioles forming linear inflated areas up to 10 mm. long. Peridia cupulate, margins expanded, not revolute, white, deeply and irregularly laciniate. Spores subglobose to polygonal, 20–22 mmm. diam.; epispore minutely and closely verruculose, 4 mmm. thick, hyaline, cell-contents tinted pale yellow.

II. Uredosori hypophyllous, pale yellow, scattered, pulverulent, up to 0·5 mm. diam., elliptical or circular, surrounded by the ruptured epidermis: Spores obovate or elliptical, 26–30 × 19–25 mmm.; epispore moderately and somewhat coarsely echinulate, 3 mmm. thick, hyaline, cell-contents tinted yellow, with 2–4 indistinct scattered germ-pores on one face.

III. Teleutosori hypophyllous, minute, lenticular, dark chocolate-brown, pulverulent, 0·5 mm. long, long covered, finally becoming exposed by the epidermis rupturing longitudinally. Spores elliptical or subclavate, 35–45 × 21–26 mmm.; apex rounded, slightly (4 mmm.) thickened, base attenuate, frequently rounded, basal cell slightly narrower than the upper; slightly constricted at the septum; epispore smooth, 2 mmm. thick, chestnut-brown, cell-contents granular, nuclei conspicuous; pedicel persistent, hyaline, fragile, up to 50 × 5 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore one-half to two-thirds below septum, conspicuous, both occasionally papillate.

Host: *Angelica Gingidium* Hook f. On leaves, stems, and petioles. Herb. Nos. 289, 364. I, II, III. Punch-bowl Falls, Arthur's Pass (Canterbury), *E. H. Atkinson!* 31 Jan., 1920. (Type.) Otira Gorge (Westland), *W. D. Reid!* 20 Nov., 1921. II, III. Greenstone Valley, 500 m.; Kinloch, 870 m.; Routeburn Valley, 700 m. (Otago); *W. D. Reid!* April, May, 1921.

The host is endemic, and occurs in both Islands (Cheeseman, 1906, p. 222). The aecidia are conspicuous and numerous; the uredo- and teleutosori, on account of their small size, are easily overlooked.

Aecidium Anisotomes Reich., recorded as occurring on *Anisotome geniculata* Hook. f. (= *Angelica Gingidium*), may belong to this species, but the description given does not agree with the above.

This species, although it shows a general resemblance to *Puccinia Angelicae* Fcl., differs from the latter species in the uredospores not being thickened at the apex, in the presence of aecidia, and in minor differences in the teleutospores and sori.

Characterized by the smooth epispore, and slightly or not thickened apex of the teleutospore.

28. Puccinia Hydrocotyles Cooke. (Text-fig. 47, and Plate 77, fig. 10.)

Cke., *Grev.*, vol. 9, p. 14, 1880.

Caeoma Hydrocotyles Link., in Willd., *Sp. Pl.*, vol. 6, p. 22, 1825. *Trichobasis Hydrocotyles* Cke., *Jour. Bot.*, vol. 2, p. 344, 1864.

0. Spermogones epiphyllous, associated with the aecidia, arranged in small groups, minute, honey-coloured.

I. Aecidia amphigenous and sparingly caulicolous, scattered or in small groups, sulphur-yellow. Peridia cupulate, tinted yellow, margins revolute, lacerate. Spores polygonal, 20–25 × 16–20 mmm.; epispore hyaline, 1 mmm. thick, minutely and densely verruculose, cell-contents pale yellow.

II. Uredosori amphigenous, chiefly hypophyllous, scattered, sometimes confluent, circular, minute, up to 0·25 mm. diam., pulverulent, cinnamon-brown, surrounded by the ruptured epidermis. Spores globose, subglobose to obovate, 24–32 × 20–28 mmm.; epispore cinnamon-brown, 2–2·5 mmm. thick, coarsely and sparsely echinulate, with 1 conspicuous germ-pore on one face.

III. Teleutosori amphigenous, chiefly epiphyllous, scattered, circular, 0·5–1 mm. diam., pulverulent, dark chestnut-brown, surrounded by the ruptured epidermis. Spores elliptical, 38–46 × 20–26 mmm.: apex rounded;

not or scarcely thickened, base rounded, both cells same size and colour; slightly constricted at the septum; epispore smooth or with a few coarse warts, 2 mmm. thick, chestnut-brown, cell-contents vacuolate; pedicel persistent, hyaline, fragile, up to 40 × 6 mmm.: germ-pore of upper cell apical, sometimes one-third way down side, conspicuous, basal pore from one-half to two-thirds below septum, conspicuous, both papillate.

Hosts:—

Hydrocotyle moschata Forst. f. On leaves and petioles. Herb. No. 380. II. Tiritea, Palmerston North (Wellington), *R. Waters!* 27 Jan., 1921. II, III. Walter Peak (Otago), 670 m.; Table Bay Creek (Otago), 840 m.; *W. D. Reid!* April, 1921. II, III. Aicken's, Otira River (Westland), *W. D. Reid!* 20 Nov., 1921. I, II. Sandhills, Levin (Wellington), *E. H. Atkinson! G. H. C.* 14 Sept., 1922.

Hydrocotyle novae-zelandiae DC. Herb. Nos. 360, 361. I. Burke's Pass (Canterbury), *W. D. Reid!* 18 Nov., 1919. III. Mount Pisa (Otago), 1,170 m.; Rere Lake; Walter Peak (Otago); *W. D. Reid!* Mar., April, 1921. II, III. Waimakariri River bed, Cass (Canterbury), 500 m., *W. D. Reid!* 14 Aug., 1921. II, III. Loburn (Otago), 300 m.; Dunstan Mountains (Otago), 400 m.; *W. D. Reid!* Dec., 1921.

Hydrocotyle tripartita R. Br. Herb. No. 380. II, III. Rere Lake, Wakatipu (Otago), 370 m., *W. D. Reid!* 5 Mar., 1921.

Distribution: Europe; North and South America; Natal.

All three hosts are indigenous, two being endemic; the third, *H. tripartita*, also occurs in Australia and Tasmania (Cheeseman, 1906, pp. 195–97).

The aecidia of this rust have hitherto been recorded only from South America. In New Zealand this stage is rare, and but the two collections have been made. The teleutospores are described as being smooth, and as being covered with large, isolated, depressed, and rounded warts. In the New Zealand forms all stages between smooth and warted are found; teleutospores taken from *H. triparta* are perfectly smooth, from *H. novae-zelandiae* they are occasionally slightly warted, whilst in specimens from *H. moschata* they are decidedly warted: variations occur in specimens from different plants of the same species from different localities, however, as I have specimens from *H. moschata* with perfectly smooth teleutospores. Although teleutospore material appears to be rare elsewhere, it is abundant in New Zealand.

Characterized by the smooth (or sparsely and coarsely warted) epispore, and by the fact that the apex of the teleutospore is not thickened.

29. **Puccinia kopoti** n. sp. (Fig. 48.)

0. Spermogones amphigenous, sparse, scattered, honey-coloured.

I. Aecidia hypophyllous, sparse, scattered, minute. Peridia cylindrical, standing above leaf-surface, margins erect, white, lacerate. Spores polygonal, 18–24 mmm. diam.; epispore minutely and closely verruculose, hyaline, 2 mmm. thick, cell-contents pallid orange.

II. Uredosori hypophyllous, pallid yellow, elliptical, 1·5 mm. long, scattered, pulverulent, bullate, epidermis fissuring longitudinally. Spores obovate to elliptical, 25–35 × 16–20 mmm.; epispore coarsely and sparsely echinulate, 1·5–2 mmm. thick, hyaline, cell-contents sulphur-yellow, with three scattered germ-pores on one face.

III. Teleutosori amphigenous, scattered, circular to elliptical, 0·25–0·5 mm. diam., bullate, pulverulent, chocolate-brown, long covered, finally surrounded by the ruptured epidermis. Spores elliptical or frequently subclavate, 30–40 × 18–22 mmm.; apex rounded, not or scarcely (4 mmm.) thickened, base abruptly attenuate, frequently rounded, basal cell usually narrower than upper; slightly constricted at the septum; epispore finely and closely covered with minute blunt warts, 1·5–2 mmm. thick, chestnut-brown, cell-contents vacuolate; pedicel hyaline, deciduous, delicate, up to 45 × 5 mmm.; germ-pore of upper cell apical, conspicuous, papillate, basal pore half-way down side below septum, conspicuous, papillate.

Host: *Anisotome aromatica* Hook. f. On leaves and petioles. Herb. No. 377. I, II, III. Lake Harris (Otago), 1,100 m., *W. D. Reid!* 6 May, 1921. (Type.)

This species, although close to *P. cuniculi*, is separated because of the scattered aecidia, more elliptical uredospores, and warted teleutospores.

The teleutospores are more irregular than in the former species, and more clavate in shape.

30. Puccinia Oreomyrrhidis n. sp. (Fig. 49.)

0. Spermogones amphigenous, scattered, minute, honey-coloured.

III. Teleutosori amphigenous, chiefly hypophyllous, and caulicolous, at first scattered, circular, minute, up to 0·5 mm. diam., and surrounded by the ruptured epidermis, becoming confluent and pulverulent until frequently the whole under-surface of the leaf becomes covered. Spores elliptical, seldom subclavate, 31–45 × 17–20 mmm.; apex rounded, slightly thickened, 3–3·5 mmm., base attenuate, basal cell slightly longer and narrower than upper; constricted at the septum; epispore minutely but distinctly punctate, 1·5–2 mmm. thick, chestnut-brown, cell-contents vacuolate; pedicel persistent, hyaline, fragile, up to 80 × 8 mmm.; germ-pore of upper cell apical, conspicuous, basal pore three-fourths way below septum, conspicuous.

X. Mesospores uncommon, obovate to clavate, somewhat truncate, 22–28 × 15–25 mmm.

Host: *Oreomyrrhis andicola* Endl. On leaves. Herb. No. 278. III. Glen Wye, Hanmer (Canterbury), *W. D. Reid!* 25 Oct., 1919. (Type.)

The host is indigenous and widespread; it occurs also in Australia, Tasmania, and South America (Cheeseman, 1906, p. 206).

The sori frequently cover the entire under-surfaces of the leaves, rendering them very conspicuous. About 1 per cent. of small spores are present in the sori; these are similar in appearance to the normal spores save only in size, which, on the average, is 31 × 17 mmm. (Fig. 49, No. 4.)

Characterized by the punctate epispore of the teleutospore.

31. Puccinia Thuemeni (Thuemen) McAlpine. (Fig. 50.)

McAlp., *Rusts Aus.*, p. 168, 1906.

Puccinia Castagnei Thuemen, *Rev. Myc.*, vol. 2, p. 86, 1880.

0. Spermogones amphigenous, in groups on minute raised spots, honey-coloured.

II. Uredosori amphigenous, circular or elliptical, up to 1·5 mm. diam., scattered or crowded, becoming confluent, pulverulent, bullate, cinnamon-brown, surrounded by the ruptured epidermis. Spores obovate or elliptical, 25–38 × 19–22 mmm.; apex thickened, up to 8 mmm.; epispore golden-brown, coarsely and sparsely verruculose, 2–2·5 mmm. thick, with 3–4 equatorial germ-pores on one face.

III. Teleutosori similar to the uredosori but dark chestnut-brown. Spores subclavate or broadly elliptical, 29–40 × 16–22 mmm.; apex rounded, not thickened, base rounded, seldom subattenuate, both cells usually same size and colour, lower sometimes slightly narrower; slightly or not constricted at the septum; epispore golden-brown, finely and sparsely verrucose, 1·5–2 mmm. thick; pedicel deciduous, hyaline, short, up to 35 × 5 mmm.; germ-pore of the upper cell apical, conspicuous, papillate, basal pore two-thirds below the septum, conspicuous, papillate.

Host: *Apium prostratum* (DC.) Lab. On leaves and stems. Herb. No. 313. II. Seashore, Seatoun (Wellington), *G. H. C.* 10 Feb., 1921.

Distribution: Australia; Tasmania.

The host is indigenous, and occurs also in Australia, Tasmania, Antarctic America, and South Africa (Cheeseman, 1906, p. 205).

Characterized by the non-thickened apex and warted epispore of the teleutospores, and the thickened apex of the uredospores.

I am indebted to Mr. C. C. Brittlebank for material of this rust for comparative purposes.

32. Puccinia Cockaynei n. sp. (Fig. 51.) Gentianaceae (15).

0. Spermogones amphigenous, seated on yellow spots, mixed with or surrounding the uredosori, immersed, honey-coloured.

II. Uredosori amphigenous, chestnut-brown, circular to elliptical, minute, up to 1 mm. diam., scattered, pulverulent, bullate, surrounded by the ruptured epidermis. Spores subglobose, elliptical, or commonly obovate, 20–32 × 17–26 mmm.; epispore finely and sparsely echinulate, 2 mmm. thick, cinnamon-brown, with one conspicuous germ-pore on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, chocolate-brown, circular to elliptical, up to 1 mm. diam., scattered, pulverulent, surrounded by the ruptured epidermis. Spores clavate, seldom elliptical, 30–38 × 18–24 mmm.; apex bluntly rounded, frequently bluntly acuminate, thickened up to 6 mmm., base attenuate, seldom rounded, basal cell narrower and lighter in colour than the upper; slightly constricted at the septum; epispore chestnut-brown, smooth, 1·5–2 mmm. thick, cell-contents vacuolate, nuclei evident; pedicel deciduous, hyaline, fragile, up to 50 × 8 mmm.; germ-pore of the upper cell apical, conspicuous, basal pore immediately below the septum, conspicuous, sometimes papillate.

X. Mesospores rare, subglobose or elliptical, 18–22 × 16–20 mmm.

Hosts:—

Gentiana corymbifera T. Kirk. On leaves. Herb. Nos. 186, 349, 374. II, III. Queenstown (Otago), *E. H. Atkinson!* 22 Jan., 1920. (Type.) II, III. Mount Peel (Canterbury), 600 m., *H. H. Allan!* 6 Mar., 1921. Ben Lomond Spur; Mount Cardrona; Mount Dick; Kinloch (Otago), 400–1,200 m., *W. D. Reid!* Mar., April, May, 1921. II. Mount Isobel, Hanmer (Canterbury), 1,170 m., *W. D. Reid!* 4 Nov., 1921.

Gentiana Grisebachii Hook. f. On leaves. II. Makarora Flat (Otago), *W. D. Reid!* 26 Mar., 1921.

Both hosts are endemic, *G. corymbifera* being confined to the South Island (Cheeseman, 1906, pp. 448–49). The teleutospores are regular in shape, and are remarkably uniform on the different collections from different localities.

This species differs from *P. tararua* G. H. Cunn. in that the latter rust possesses fusiform teleutospores. Although showing a general resemblance to *P. Gentianae* Link., this species differs in the thickened, non-apiculated apex and attenuated base of the teleutospore.

I have named this rust in honour of A. H. Cockayne, Government Biologist, whose constant advice and assistance have made this work possible.

33. Puccinia tararua n. sp. (Fig. 52.)

0. Spermogones amphigenous, sparse, scattered, immersed, honey-coloured.

II. Uredosori amphigenous and caulicolous, scattered or aggregated into irregular groups, up to 2 mm. diam., circular, pulverulent, cinnamon-brown, surrounded by the ruptured epidermis. Spores obovate, less commonly subglobose, 20–30 × 18–23 mmm.; epispore coarsely and sparsely echinulate, 4 mmm. thick, pale yellow, with one prominent germ-pore on the one face.

III. Teleutosori amphigenous and caulicolous, scattered, circular, up to 1 mm. diam., chestnut-brown, pulvinate, compact, surrounded by the ruptured epidermis. Spores fusiform, 50–70 × 10–15 mmm.; apex bluntly acuminate or rounded, thickened up to 10 mmm., base attenuate, tapering gradually into pedicel, both cells same size and colour; slightly or not constricted at the septum; epispore smooth, 1 mmm. thick, tinted pallid brown, or ochraceous, cell-contents vacuolate; pedicel persistent, hyaline, stout, up to 50 × 10 mmm., continuous with spore; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

Host: *Gentiana patula* Cheesem. On leaves and stems. Herb. No. 379. II, III. Table-top, Mount Hector (Wellington), 1,170 m., *E. H. Atkinson!* 6 Feb., 1921. (Type.)

The host is endemic, and in the North Island is confined to the Tararua Range; in the South Island it appears to be common in mountainous country (Cheeseman, 1906, p. 452).

This species is characterized by the thin-walled fusiform teleutospores.

34. Puccinia Dichondrae Montagne. (Fig. 53.) Convolvulaceae (16).

Mont., in C. Gay's *Fl. Chile*, vol. 8, p. 46, 1852.

Puccinia Dichondrae Berk., *Linn. Jour. Bot.*, vol. 13, p. 173, 1872. *P. Berkeleyana* De Toni, in *Sacc. Syll.*, vol. 7, p. 717, 1888. *P. munita* Ludw., *Zeits. f. Pflanzenkr.*, vol. 2, p. 133, 1892.

0. Unknown.

III. Teleutosori amphigenous, chiefly hypophyllous, chocolate-brown, circular, minute, up to 200 mmm. diam., pulverulent, at first scattered, becoming confluent until finally the whole leaf-surface becomes covered. Spores elliptical to subclavate, 30–50 × 15–25 mmm.; apex rounded, sometimes bluntly acuminate, thickened up to 5 mmm., or not thickened, usually with a coloured apiculus, sometimes two, base subattenuate, frequently rounded, basal cell somewhat narrower than the upper; constricted at the septum; epispore smooth, 1–1·5 mmm. thick, golden-brown, cell-contents granular, nuclei conspicuous; pedicel persistent, hyaline, sometimes tinted, fragile, up to 46 × 5 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure, both papillate.

X. Mesospores uncommon, elliptical, 21–30 × 15–22 mmm.; apex rounded and apiculate.

Hosts :—

Dichondra repens Forst. f. On leaves. Herb. No. 74. III. Ashburton (Canterbury), *H. H. Allan!* 20 Nov., 1919.

Dichondra brevifolia Buch. On leaves. III. Macraes (Otago), 600 m., *W. D. Reid!* 29 Nov., 1921.

Distribution : Australia ; Tasmania ; North and South America.

The hosts are indigenous, one being endemic, the other, *D. repens*, occurring also in the tropical and subtropical districts of both hemispheres (Cheeseman, 1906, p. 478). The marked heteromorphy mentioned by McAlpine (1906, p. 143) as occurring in the Australian specimens is not present in the New Zealand forms. An occasional vertical septum is seen, but one-celled and more than two-celled forms are rare. The most variable feature appears to be the position of the apiculus, which may be apical, or anywhere on the side. Frequently two or more are present on the same spore. I find them to be coloured ; McAlpine states that they are hyaline.

35. **Puccinia Menthae** Persoon. (Fig. 54.) Labiatae (17).

Pers., *Syn. Fungi*, p. 227, 1801.

Uredo Menthae Pers., *l.c.*, p. 220. *Aecidium Menthae* Sow., *Engl. Fungi*, pl. 398, fig. 3, 1803. *Uredo Calaminthae* Strauss., *Ann. Wettst. Ges.*, vol. 2, p. 95, 1810. *Puccinia Clinopodii* DC., *Fl. Fr.*, vol. 6, p. 67, 1815. *Uredo Labiatarum* DC., *l.c.*, p. 72. *U. Menthastri* Link., *Ges. Nat. Fruende Berlin Mag.*, vol. 7, p. 27, 1815. *Dicaeoma Menthae* S. F. Gray, *Nat. Arr. Brit. Pl.*, vol. 1, p. 542, 1821. *Uredo Clinopodii* Schw., *Schr. Nat. Ges. Leipsig*, vol. 1, p. 70, 1822. *Caeoma Labiatarum* Schlecht., *Fl. Berol.*, vol. 2, p. 128, 1824. *Puccinia Labiatarum* Schlecht., *l.c.*, p. 133. *Caeoma menthatum* Link., in Willd., *Sp. Pl.*, vol. 6, p. 47, 1825. *Puccinia Pycnanthemi* Schw., *Trans. Am. Phil. Soc.*, ser. 2, vol. 4, p. 295, 1832. *Uredo Satureiae* Cast., *Cat. Pl. Marseille*, Suppl. 89, 1851. *Aecidium ovoideo-aurantium* Bon., *Coniom.*, 45, 1860. *Puccinia Calaminthae* Fcl., *Symb. Myc.*, p. 56, 1869. *P. Menthae americana* Burrill, *Bull. Ill. Lab. Nat. Hist.*, vol. 2, p. 191, 1885. *Dicaeoma Pycnanthemi* Kuntze, *Rev. Gen.*, vol. 3, p. 470, 1898.

0. Spermogones amphigenous, in small groups, honey-coloured.

I. Aecidia amphigenous, chiefly hypophyllous, and caulicolous, on leaves seated on inflated orange or purplish areas, gregarious, on stems elliptical, yellow. Peridia cupulate, 0·25 mm. diam., margins white, erect, or somewhat incurved, lacerate. Spores 22–36 × 16–26 mmm., globose or elliptical ; epispore pallid yellow, 1·5–2 mmm. thick, densely and coarsely verruculose, cell-contents orange-yellow.

II. Uredosori hypophyllous, on yellow spots, scattered, circular, minute, 0·25–0·5 mm. diam., cinnamon-brown, pulverulent, surrounded by the ruptured epidermis. Spores globose to obovate, 20–28 × 16–20 mmm. ; epispore sparsely and coarsely echinulate, pallid brown, 1·5 mmm. thick, with 3 equatorial germ-pores on one face.

III. Teleutosori hypophyllous, scattered, minute, up to 0·5 mm. diam., chocolate-brown, pulverulent, surrounded by the ruptured epidermis. Spores broadly elliptical, 22–32 × 18–23 mmm. ; apex rounded, not thickened, base rounded, both cells same size and colour ; slightly or not constricted at the septum ; epispore somewhat sparsely and minutely verrucose, 1–2 mmm. thick, chestnut-brown ; pedicel persistent, hyaline, fragile, up to 40 × 5 mmm. ; germ-pore of upper cell apical, conspicuous, basal pore varying in position between septum and pedicel, conspicuous, papillate.

Host : *Mentha Cunninghamii* Benth. On leaves. Herb. No. 348. II, III. Table Bay (Otago), 835 m., *W. D. Reid!* 29 April, 1921.

Distribution: Australia; North America; Europe; Asia; Africa.

The aecidial stage has not been collected in New Zealand. The host is endemic and widely distributed (Cheeseman, 1906, p. 568).

I am indebted to Dr. Grove for specimens of this rust for comparative purposes. The mycelium of the aecidia is perennial. There are minor differences between our form and the European; these are not as great, however, as the differences between European and American specimens that I have in the herbarium.

36. Puccinia pedatissima n. sp. (Fig. 55.) Scrophulariaceae (18).

0. Unknown.

III. Teleutosori hypophyllous, minute, circular, 0·1–0·25 mm. diam., closely aggregated in minute scattered circular groups up to 2 mm. diam., compact, pulvinate, naked, ochraceous. Spores elliptical or shortly fusoid, 40–52 × 14–18 mmm.; apex bluntly acuminate, thickened up to 8 mmm., base attenuate, both cells same size or basal cell somewhat narrower, cell-contents granular, nuclei conspicuous; slightly or not constricted at the septum; epispore smooth, 1–1·5 mmm. thick, tinted brown; pedicel persistent, hyaline, up to 40 × 6 mmm., continuous with the spore; germ-pore of upper cell apical, obscure, basal pore immediately beneath the septum, obscure.

X. Mesospores uncommon, 25–30 × 12–16 mmm.; apex acuminate and thickened.

Host: *Ourisia macrophylla* Hook. On leaves, veins, and petioles. Herb. No. 494. III. Mount Egmont (Taranaki), 1,200 m., *W. D. Reid! N. R. Foy!* 2 Jan., 1922. (Type.)

The host is endemic and confined to the mountain regions of both Islands (Cheeseman, 1906, p. 549). The spores germinate immediately on reaching maturity. This species is closely related to *Puccinia apus* Diet. et Neg., but differs chiefly in the hypophyllous sori, larger teleutospores, and *persistent* pedicels.

37. Puccinia Coprosmae Cooke. (Fig. 56.) Rubiaceae (19).

Cke., *Grev.*, vol. 19, p. 2, 1890.

Puccinia Coprosmatis Morrison, *Vic. Nat.*, vol. 11, p. 90, 1894.

0. Unknown.

III. Teleutosori hypophyllous, closely crowded on discoloured spots which may reach a diam. of 5 mm., circular or elliptical, pulvinate, compact, at first covered, finally becoming exposed by the epidermis falling away in patches from the surface, but remaining surrounding the sori at the base. Spores elongate-oblong or clavate, 36–50 × 16–21 mmm.; apex bluntly acuminate, rounded, thickened up to 8 mmm., base rounded, frequently attenuate, basal cell same length as upper but somewhat narrower and lighter in colour; constricted at the septum; epispore smooth, tinted brown, 2 mmm. thick, cell-contents vacuolate; pedicel persistent, tinted, up to 100 × 8 mmm., continuous with the spore; germ-pore of the upper cell apical, conspicuous, basal pore immediately beneath the septum, conspicuous.

X. Mesospores common, obovate or elliptical, 21–38 × 14–20 mmm., apex acuminate.

Hosts :—

Coprosma grandifolia Hook. f. On leaves. Herb. Nos. 6, 320. III. Botanical Gardens, Palmerston North (Wellington), *R. Waters!* 27 Jan., 1921.

Coprosma lucida Forst. f. On leaves. III. Stewart Island, *T. Kirk!* 1888. (Cotype.) York Bay (Wellington), *E. H. Atkinson!* 13 Feb., 1921. Ben Lomond Spur; Makarora (Otago), *W. D. Reid!* Mar., 1921.

Coprosma robusta Raoul. On leaves. III. Lake Papaetonga, Weraroa (Wellington), *G. H. C.* 31 Dec., 1919. Otira Gorge (Canterbury), *E. H. Atkinson!* 30 Jan., 1920.

Distribution: Australia; Tasmania.

All three hosts are endemic and widespread (Cheeseman, 1906 pp. 246–48). On *C. robusta* this fungus forms large brown spots which are very conspicuous; on *C. lucida* these spots are much less common, and are frequently absent.

Cooke's description is so fragmentary that it would be wellnigh impossible to determine any species from it; fortunately I have the cotype material from which the species was named, and the above description is drawn up from this. This is one of our commonest indigenous rusts.

38. **Puccinia aucta** Berkeley and F. v. Mueller. (Fig. 57.)
Campanulaceae (20).

Berk. et F. v. M., *Linn. Jour.*, vol. 13, p. 173, 1872.

0. Unknown.

III. Teleutosori hypophyllous, frequently covering the entire undersurface of the leaf, cinnamon-brown, circular, scattered, often confluent, pulvinate, compact, 0·5 mm. diam., surrounded by the ruptured epidermis. Spores subclavate, 35–70 × 15–26 mmm.; apex rounded, truncate, or frequently bluntly acuminate, thickened up to 11 mmm., base attenuate, basal cell narrower and longer than the upper, frequently cylindrical, sometimes lighter in colour; constricted at the septum, often markedly; epispore smooth, 1–1·5 mmm. thick, tinted pale brown, cell-contents granular, nuclei conspicuous; pedicel persistent, tinted, short, stout, up to 35 × 12 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below the septum, obscure, seldom papillate.

Host: *Lobelia anceps* Linn. f. On leaves and stems. Herb. No. 312. III. Seashore, Pencarrow (Wellington), *E. H. Atkinson!* 10 Feb., 1921. Seashore, Seatoun (Wellington), *G. H. C.* 10 Feb., 1921.

Distribution: South Australia.

The host is indigenous and widespread; it occurs also in Australia (Cheeseman, 1906, p. 400). Although McAlpine (1906, p. 148) describes in connection with this species an aecidium occurring on the same host, I consider the two forms to belong to different species, because in New Zealand, where the teleutospores are common, no aecidia are found, whereas in Australia but one (the type) collection has been made of the teleutospores, where an aecidium appears to be common on various species of *Lobelia* and on *Pratia* spp., a closely related genus. McAlpine states that he has not found the two forms on the same host at the same time, but groups them together as a matter of convenience until such time as their relationships are proven.

39. Puccinia Allanii n. sp. (Fig. 58.) Compositae (21).

0. Spermogones amphigenous, sparse, a few mixed with the aecidia, honey-coloured.

I. Aecidia amphigenous, closely aggregated on discoloured spots, in more or less circular groups, yellow. Peridia cupulate, margins expanded, but not revolute, lacerate, white. Spores polygonal, frequently subglobose, 12–18 mm. diam.; epispore verruculose, 1 mmm. thick, hyaline, cell-contents orange.

III. Teleutosori hypophyllous, associated with the aecidia, minute, 0·25–0·5 mm. diam., circular, pulvinate, compact, dark chestnut-brown, surrounded by the ruptured epidermis. Spores elliptical, commonly subclavate, 35–55 × 18–26 mmm.; apex rounded, often bluntly acuminate, thickened up to 10 mmm., darker in colour, base attenuate, upper cell darker in colour and somewhat broader than lower; constricted at the septum; epispore smooth, chestnut-brown, 3 mmm. thick in upper cell, 2 mmm. in lower; pedicel persistent, tinted, up to 50 × 10 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, obscure.

Host: *Senecio lagopus* Raoul. On leaves. Herb. No. 425. I, III. Mount Herbert, Banks Peninsula (Canterbury), *H. H. Allan!* 5 Feb., 1921. (Type.)

The host is endemic and fairly widely distributed (Cheeseman, 1906, p. 370). This species is named in honour of Dr. H. H. Allan, of Feilding, who has forwarded numerous specimens of rusts he has collected during his many botanical expeditions in the Canterbury mountains.

Distinguished by the thickened, capped apex, thick epispore, and conspicuous apical germ-pore of the teleutospores. The sorus characters serve to distinguish it from *P. pounamu* and others which show a general resemblance to this species.

40. Puccinia Atkinsonii n. sp. (Fig. 59.)

0. Spermogones hypophyllous, associated with the aecidia, minute, immersed, honey-brown.

I. Aecidia hypophyllous, aggregated in large closely-packed groups on distorted spots which are visible on the upper surface as dark-brown dead areas, up to 25 mm. in length, circular or linear, in mass bright orange. Peridia embedded, margins alone showing, depressed-globose, up to 800 mmm. wide by 450 mmm. high, margin entire, upright. Spores subglobose, elliptical, frequently lacrimiform, with an elongated hyaline apiculus, 25–35 × 15–22 mmm.; epispore densely and minutely verrucose, 2 mmm. thick, hyaline, cell-contents reddish-orange, granular.

III. Teleutosori hypophyllous, on minute dark-brown spots which are visible on the upper surface, dark chocolate-brown, almost black, circular, up to 0·5 mm. diam., scattered at first, covered by the dense tomentum of the leaf, becoming erumpent and pulverulent. Spores broadly elliptical, 40–65 × 20–35 mmm.; apex retuse, less frequently papillate, thickened up to 7 mmm. or not thickened, base rounded, seldom attenuate, both cells same size and colour; slightly constricted at the septum; epispore smooth, 2·5–3 mmm. thick, pale chestnut-brown, cell-contents vacuolate; pedicel deciduous, hyaline, up to 45 × 8 mmm.; germ-pore of the upper cell apical or more frequently varying in position between apex and septum, basal pore usually one-third below septum, both markedly conspicuous and at first papillate, later the papilla collapses and an indentation in the epispore over the germ-pore is formed.

X. Mesopores uncommon, subglobose, elliptical to obovate, 35–55 × 38–45 mmm.

Host: *Olearia excorticata* Buch. On leaves. Herb. No. 308. I, III. Table-top, Mount Hector (Wellington), 1,170 m., *E. H. Atkinson!* 6 Feb., 1921. (Type.)

The host is endemic and rather uncommon, being confined to the Tararua Range in the North Island, and to the subalpine scrub of the Westland district in the South Island (Cheeseman, 1906, p. 287).

The aecidia form bright-orange patches up to 25 mm. long on the leaves; they are much more conspicuous than the teleutosori, which are easily overlooked. Young teleutospores have orange contents, and the germ-pores are strongly papillate; after a time the colour changes to light brown, and the papilla collapses or becomes inverted, forming a minute conical indentation in the epispore above the germ-pore; this peculiarity is more noticeable over the apical, but is quite common above the basal pore.

This rust is named in honour of Esmond H. Atkinson, of the Biological Laboratory, who has collected many of the specimens in my herbarium. He has, moreover, verified the host plants—no mean undertaking, considering the fragmentary nature of much of the material, as in many instances leaves alone are collected and forwarded.

Characterized by the thick-walled epispore of the teleutospore, and the peculiar thickened, retuse apex.

41. Puccinia Cardui-pycnocephali Sydow. (Fig. 60.)

Syd., *Mon. Ured.*, vol. 1, p. 34, 1902.

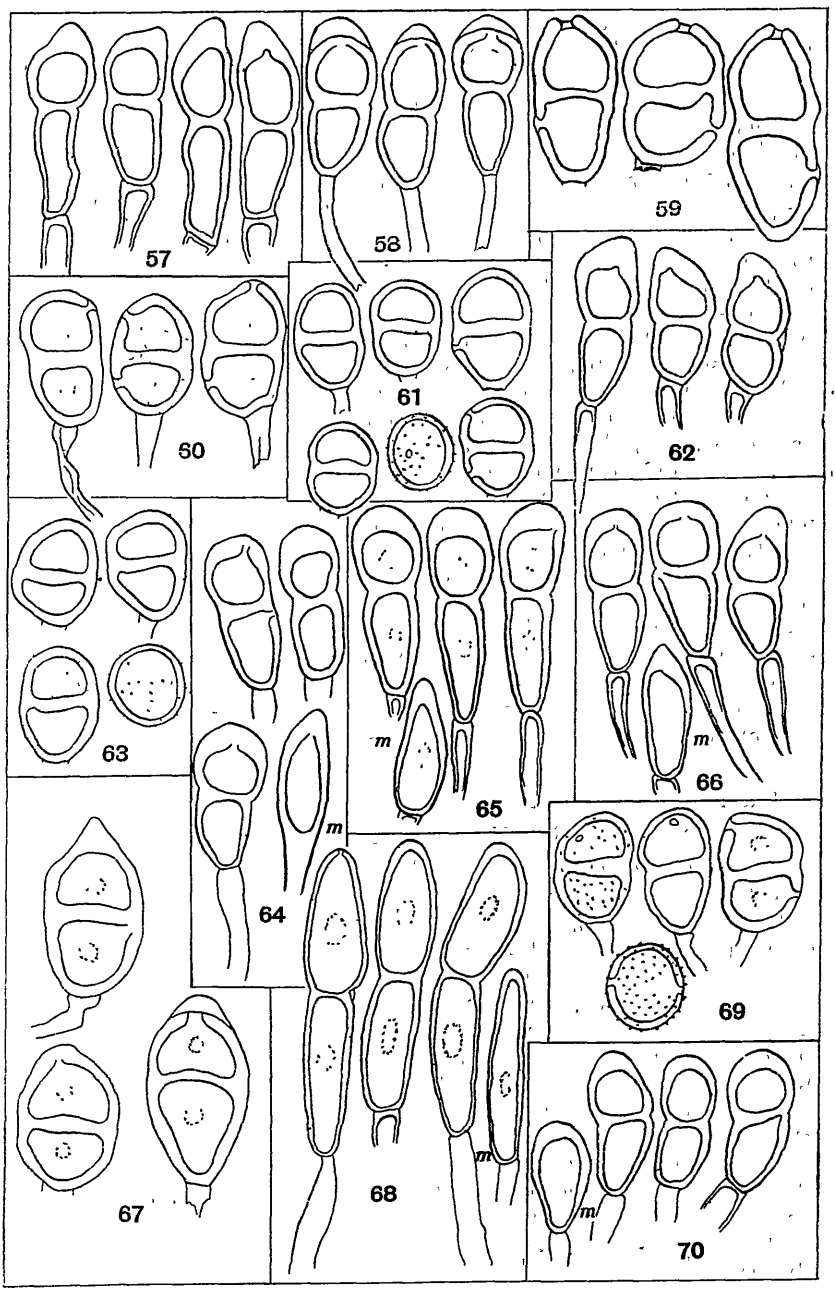
Puccinia galatica Syd., *Mon. Ured.*, vol. 1, p. 34, 1902.

0, I. Unknown.

II. Uredosori amphigenous, chestnut-brown, circular, scattered, pulverulent, 0·5–1 mm. diam., surrounded by the ruptured epidermis. Spores globose, subglobose, to ovate, 27–33 × 22–28 mmm.; epispore evenly and closely echinulate, 2–2·5 mmm. thick, thickened to 4 mmm. above insertion of pedicel, with 2–3 scattered, papillate germ-pores on one face.

Fig. 57.—*Puccinia aucta* Berk. et F. v. M. Teleutospores from *Lobelia anceps* Linn. f.
Fig. 58.—*Puccinia Allanii* sp. nov. Teleutospores from *Senecio lagopus* Raoul.
Fig. 59.—*Puccinia Atkinsonii* sp. nov. Teleutospores from *Olearia excorticata* Buch.
Fig. 60.—*Puccinia Cardui-pycnocephali* Syd. Teleutospores from *Carduus pycnocephalus* L.
Fig. 61.—*Puccinia Cichorii* Bell. Uredo- and teleuto-spores from *Cichorium Intybus* L.
Fig. 62.—*Puccinia Cinerariae* McAlp. Teleutospores from *Cineraria* sp. cult.
Fig. 63.—*Puccinia Cyani* Pass. Uredo- and teleuto-spores from *Centaurea Cyanus* L.
Fig. 64.—*Puccinia distincta* McAlp. Teleutospores from *Bellis perennis* L.
Fig. 65.—*Puccinia egmontensis* sp. nov. Teleutospores from *Celmisia glandulosa* Hook. f.
Fig. 66.—*Puccinia Erechtitis* McAlp. Teleutospores from *Erechtites prenanthoides* DC
Fig. 67.—*Puccinia fodiens* sp. nov. Teleutospores from *Celmisia rigida* (T. Kirk) Cockayne.
Fig. 68.—*Puccinia hectorensis* sp. nov. Teleutospores from *Senecio Bidwillii* Hook. f Reduced scale. × 325.
Fig. 69.—*Puccinia Hypochoeridis* Oud. Uredo- and teleuto-spores from *Hypochoeris glabra* L.
Fig. 70.—*Puccinia Lagenophorae* Cke. Teleutospores from *Lagenophora Barkeri* T. Kirk.

Camera-lucida drawings by author. All × 500 except fig. 68. *m* = mesopores.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III. Teleutosori amphigenous and caulicolous, chocolate-brown, circular, scattered, pulvinate, compact, 0·5–1 mm. diam., at first covered, soon naked and embedded in tomentum of leaf. Spores elliptical, oblong, sometimes subclavate, 30–48 × 20–28 mmm.; apex rounded, rarely truncate, not thickened, base rounded, basal cell same size and colour as upper, seldom slightly narrower; slightly constricted at the septum; epispore verruculose, 2·5–3 mmm. thick, cell-contents granular, nuclei prominent; pedicel persistent, fragile, hyaline, up to 60 × 7 mmm.; germ-pore of the upper cell apical or one-quarter way down one side, conspicuous, basal pore one-quarter way below septum, conspicuous, both occasionally papillate.

Host: *Carduus pycnocephalus* L. On leaves and stems. Herb. Nos. 270, 316, 357. III. Fitzroy Bay (Wellington), *E. H. Atkinson!* 17 Mar., 1920. II, III. Cluny, Turakina (Wellington), *G. H. C.* 2 Jan., 1921. III. Dunstan Mountains (Otago), 500 m., *A. H. Cockayne!* 8 Feb., 1921. II. Walter Peak (Otago), 440 m., *W. D. Reid!* 27 April, 1921.

Distribution: Britain; Italy; Asia Minor.

The host is a thistle common in drier localities throughout New Zealand; it has been introduced from Europe, probably in grass-seed. The rust is common wherever the host occurs; it appears to check seed-development in the host, as one commonly finds sterile flower-heads in infected plants.

I am indebted to Dr. W. B. Grove for the determination of this species from specimens forwarded; I was under the impression that it was *P. galatica* Syd., but Dr. Grove informs me that in a later publication Sydow admitted that the latter name was a synonym. Unfortunately I have been unable to obtain access to Sydow's *Monograph*.

In his description (of *P. galatica*) Sydow states that the teleutospore is finely punctate. Grove (1913, p. 142) states that the teleutospore is smooth. I find that when the spores are mounted dry and examined they are seen to be distinctly verruculose.

Characterized by the thick, verruculose epispore of the teleutospore.

42. Puccinia Chrysanthemi Roze.

Roze, *Bull. Soc. Myc. France*, vol. 17, p. 92, 1900.

Puccinia Chrysanthemi-chinensis P. Henn., *Hedw. Beibl.*, vol. 40, p. 26. 1901.

0, I. Unknown.

II. Uredosori amphigenous, chiefly hypophyllous, sometimes caulicolous, on brown dead spots which are visible on the opposite surface of the leaf, cinnamon-brown, circular, seldom elliptical, scattered, frequently confluent, sometimes circinnate, pulverulent, up to 2 mm. diam., surrounded by the ruptured epidermis. Spores elliptical or obovate, seldom subglobose, 20–34 × 20–25 mmm.; epispore moderately echinulate, 2–2·5 mmm. thick, cinnamon-brown, with 3 equatorial germ-pores on one face.

III. Teleutosori amphigenous, chiefly hypophyllous, chocolate-brown, circular, scattered, or confluent, frequently circinnate, pulvinate, compact, soon naked. Spores elliptical, clavate, or often pyriform, 38–55 × 20–26 mmm.; apex rounded, rarely truncate, thickened up to 7 mmm., base rounded, seldom attenuate, basal cell slightly narrower and lighter in colour than upper; slightly constricted at the septum; epispore finely but distinctly punctate, 1·5–2 mmm. thick, chestnut-brown, cell-contents coarsely vacuolate; pedicel persistent, hyaline, stout, up to 80 × 9 mmm.; germ-pore of upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores rare, elliptical to clavate, 28–46 × 22–25 mmm.; apex thickened.

Host: *Chrysanthemum indicum* L. On leaves and stems. Herb. No. 73. II. Palmerston North (Wellington), *G. H. C.* 4 June, 1919.

Distribution: Australia; Japan; Europe; North America.

The uredospore stage alone has been collected in New Zealand. The above description of the teleutospores was drawn up from material kindly supplied by Mrs. F. W. Patterson. The teleutospores appear to be rare everywhere, with the exception of Japan, where they are stated to be abundant.

Characterized by the thick apex and punctate epispore of the teleutospore.

43. Puccinia Cichorii Bellynck. (Fig. 61.)

Bell., in Kickx *Fl. Crypt. Fland.*, vol. 2, p. 65, 1867.

Puccinia Hieracii Mart., *Fl. Mosq.*, p. 226, 1812. *Uredo Cichorii* DC., *Fl. Fr.*, vol. 6, p. 74, 1815.

0, I. Unknown.

II. Uredosori amphigenous and caulicolous, cinnamon-brown, circular, scattered, seldom confluent, pulverulent, up to 0·5 mm. diam., surrounded by the ruptured epidermis. Spores subglobose, elliptical, or often obovate, 22–30 × 20–26 mmm.; epispore delicately and moderately echinulate, 2–2·5 mmm. thick, yellowish-brown, with 1–2 germ-pores on one face.

III. Teleutosori amphigenous and caulicolous, scattered, chocolate-brown, circular, pulvinate, compact, up to 0·5 mm. diam., surrounded by the ruptured epidermis. Spores elliptical, frequently obovate, 27–38 × 19–24 mmm.; apex rounded, not thickened, base rounded, seldom attenuate, both cells same size and colour; slightly or not constricted at the septum; epispore minutely verruculose, 2 mmm. thick, chestnut-brown, cell-contents granular; pedicel deciduous, hyaline, fragile, up to 45 × 7 mmm.; germ-pore of the upper cell one-third to two-thirds down one side, conspicuous, basal pore one-third way below septum, conspicuous.

Host: *Cichorium Intybus* L. On leaves and stems. Herb. No. 180. II, III. Lincoln (Canterbury), *T. Kirk!* 19 Nov., 1881.

Distribution: Australia; Europe.

The host, a native of Europe and Asia, has become more or less naturalized throughout the warmer parts of New Zealand. The epispore of the teleutospore is seen to be minutely verruculose when the spores are mounted dry and examined. Characterized by the verruculose epispore and non-thickened apex of the teleutospore.

44. Puccinia Cinerariae McAlpine. (Fig. 62.)

McAlp., *Rusts Aus.*, p. 155, 1906.

0. Unknown.

I. Aecidia amphigenous, compacted in groups on light-green spots, 5 mm. in diam., which are swollen on the under side and depressed on the upper, and on veins where they cause linear distortions 10 mm. or more in length, orange-yellow. Peridia cupulate, slightly projecting above the leaf-surface, 250 mmm. diam., margins white, revolute, deeply and irregularly laciniate. Spores subglobose to polygonal, 14–17 × 10–14 mmm.; epispore closely and minutely verruculose, hyaline, 1 mmm. thick, cell-contents bright orange.

III. Teleutosori amphigenous, intermixed with aecidia, chocolate-brown, circular, scattered, pulvinate, compact, minute, 0·25 mm. diam., surrounded by the ruptured epidermis. Spores clavate, 38–56 × 18–24 mmm.; apex bluntly acuminate, truncate, or rounded, thickened up to 10 mmm., darker in colour, base attenuate, basal cell longer, narrower, and lighter in colour than upper; slightly constricted at the septum; epispore smooth, 2 mmm. thick in upper cell, 1·5 mmm. in lower, chestnut-brown, cell-contents vacuolate; pedicel persistent, tinted, stout, up to 45 × 7 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below septum, obscure.

X. Mesospores rare, elliptical or obovate, 22–34 × 12–22 mmm.; apex bluntly rounded, or truncate, thickened.

Host: *Cineraria* sp. cult. On leaves. Herb. No. 305. I, III. High School grounds, Palmerston North (Wellington), *R. Waters!* 27 Jan., 1921

Distribution: Australia.

The host is one of the varieties of cultivated *Cineraria*. The aecidia form conspicuous inflated areas on the leaves; the teleutosori are rare, and difficult to find. Characterized by the clavate teleutospores, which are thickened at the apex, and have smooth epispores.

45. Puccinia Cyani Passerini. (Fig. 63.)

Pass., in Rab. *Fung. Eur.*, No. 1767, 1873.

Uredo Cyani Schleich., *Plant Helv.*, p. 95, 1805. *Puccinia Hieracii* Mart., *Fl. Mosq.*, p. 226, 1817, *p.p.* *P. suavolens* Rostr. var. *Cyani* Magnus, in Plow., *Mon. Ured.*, p. 183. 1889.

0. Spermogones amphigenous, sparse, scattered, honey-coloured.

II. Uredosori amphigenous, chiefly hypophyllous, cinnamon-brown, circular or elliptical, scattered, seldom crowded, pulverulent, up to 1·5 mm. diam., surrounded by the ruptured epidermis, soon naked. Spores globose, subglobose, or elliptical, 22–27 × 19–24 mmm.; epispore delicately and sparsely echinulate, 1·5 mmm. thick, with 2 equatorial germ-pores on one face.

III. Teleutosori amphigenous and caulicolous, chocolate-brown, circular to elliptical, scattered, seldom crowded, pulverulent, 0·5–1·5 mm. diam., surrounded by the ruptured epidermis, soon naked. Spores broadly elliptical, 32–38 × 24–29 mmm.; apex rounded, not thickened, base rounded, both cells same size and colour, very regular in shape; not or very slightly constricted at the septum; epispore densely and minutely verruculose, 3 mmm. thick, chestnut-brown, cell-contents coarsely granular; pedicel deciduous, hyaline, fragile, up to 40 × 7 mmm.; germ-pore of upper cell apical or half-way down side, conspicuous, basal pore one-third to two-thirds below septum, conspicuous.

X. Mesospores rare, elliptical, 30–35 × 25 mmm.; rounded at apex and base.

Host: *Centaurea Cyanus* L. On leaves and stems. Herb. No. 3. II, III. Palmerston North (Wellington), 14 April, 1919. Claudelands (Auckland), 27 Feb., 1921. *G. H. C.*

Distribution: Australia; Europe; North America.

The spores of this species are very regular in shape, and appear to vary but slightly in size. This rust was first included as a variety under *P. Hieracii*, but was separated on account of its possessing a thick, verruculose epispore, and because of its inability to infect any host other

than *Centaurea*. The mycelium of the primary uredosori permeates the whole plant, but does not appear to check flowering (Grove, 1913, p. 141).

Characterized by the thick verruculose epispore, and rounded non-thickened apex of the teleutospore.

46. Puccinia distincta McAlpine. (Fig. 64.)

McAlp., *Agr. Gaz. N.S.W.*, vol. 6, p. 853, 1895.

0. Unknown.

I. Aecidia amphigenous, on discoloured spots, scattered, or more frequently aggregated into closely-packed irregular groups, orange. Peridia cupulate, margins white, reflexed, lacerate. Spores subglobose to elliptical, 14–20 × 13–16 mmm.; epispore minutely and densely verruculose, hyaline, 1·5 mmm. thick, cell-contents vacuolate, orange-yellow.

III. Teleutosori amphigenous and on petioles, associated with aecidia, scattered or confluent, elliptical, 1·5 mm. long, black, bullate, compact, becoming exposed by the epidermis fissuring longitudinally. Spores clavate or fusoid, 38–55 × 17–22 mmm.; apex rounded, truncate, or acuminate, frequently oblique, thickened up to 10 mmm., and darker in colour, base attenuate, basal cell narrower and lighter in colour than upper, cell-contents granular; slightly or not constricted at the septum; epispore smooth, chestnut-brown, 1·5–2·5 mmm. thick, thinner in lower cell; pedicel persistent, tinted, stout, up to 55 × 8 mmm., continuous with spore; germ-pore of upper cell apical, conspicuous, basal pore immediately below the septum, obscure, usually papillate.

X. Mesospores common, clavate or obovate, 30–35 × 14–18 mmm.; apex acuminate and thickened; pedicel persistent.

Host: *Bellis perennis* L. On leaves, scapes, and petals. Herb. Nos. 184, 375. I. Levin; Masterton (Wellington), *G. H. C.* Sept., 1919. I, III. Tiritea, Palmerston North (Wellington), *G. H. C.* 3 Mar., 1921. Nelson, *Miss K. M. Curtis!* 30 May, 1921.

Distribution: Australia; Tasmania.

The host is an introduced plant, and is a common weed in pastures. Characterized by the thickened apex, thin, smooth epispore, and clavate or fusoid shape of the teleutospore.

47. Puccinia egmontensis n. sp. (Fig. 65.)

0. Spermogones amphigenous, in irregular groups on inflated spots, erumpent, scattered or crowded, honey-coloured.

III. Teleutosori amphigenous, in irregular groups on somewhat inflated yellow spots, surrounded by the spermogones, circular, or irregularly elliptical, sometimes circinnate, up to 2 mm. diam., pulvinate, compact, black, surrounded by the ruptured epidermis. Spores clavate, 55–65 × 15–22 mmm.; apex bluntly rounded, seldom acuminate, thickened up to 10 mmm., darker in colour, base attenuate, basal cell longer, narrower, and lighter in colour than the upper, cell-contents granular, nuclei conspicuous; slightly constricted at the septum; epispore smooth, 1·5–2 mmm. thick in the upper cell, 1–1·5 mmm. in lower, chestnut-brown; pedicel persistent, hyaline, 50 × 5 mmm., continuous with spore; germ-pore of the upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores common, elliptical or fusoid, 30–40 × 12–16 mmm.; apex acuminate.

Host: *Celmisia glandulosa* Hook. f. On leaves. Herb. No. 491. III. Mount Egmont (Taranaki), 1,170 m., *W. D. Reid! N. R. Foy!* 3 Jan., 1922. (Type.)

The host is endemic, and confined to the mountain regions of both Islands. Characterized by the thickened, rounded apex, thin epispore, and clavate shape of the teleutospore, and the absence of aecidia and uredospores.

48. Puccinia Erechtitis McAlpine. (Fig. 66.)

McAlp., *Proc. Roy. Soc. Vic.*, vol. 7 (n.s.), p. 216, 1894.

0. Spermogones epiphyllous, in groups on discoloured spots, honey-coloured.

I. Aecidia amphigenous and caulicolous, orange-yellow, crowded in irregular groups on inflated areas, which may attain a diam. of 20 mm. or more. Peridia cupulate, margins white, lacerate, revolute. Spores polygonal or elliptical, 16–19 × 12–17 mmm.; epispore 1 mmm. thick, hyaline, closely and densely verruculose, cell-contents vacuolate, orange-yellow.

III. Teleutosori amphigenous, chiefly caulicolous, in irregular groups mixed with aecidia, crowded, elliptical, 1 mm. long, becoming confluent, compact, pulvinate, black, long covered by the epidermis. Spores clavate, 40–51 × 17–25 mmm.; apex rounded, truncate, or acuminate, thickened up to 10 mmm., base attentuate, basal cell narrower and lighter in colour, cell-contents granular; constricted at the septum; epispore emooth, chestnut-brown, 2–2·5 mmm. thick in upper cell, 1–1·5 mmm. in lower; pedicel persistent, tinted, 40 × 9 mmm., continuous with spore; germ-pore of the upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores common, fusoid, or elliptical, 32–43 × 13–17 mmm.; apex thickened.

Host: *Erechtites prenanthoides* (A. Rich.) DC. On leaves and stems. Herb. No. 178. I, III. Stewart Island, *T. Kirk!* 1886.

Distribution: Australia; Tasmania.

The host is indigenous and widespread; it occurs also in Australia and Tasmania (Cheeseman, 1906, p. 364).

Closely related to *Puccinia tasmanica* Diet., on *Senecio* spp., but differing in several minor details. The teleutospores are somewhat shorter and have a somewhat thinner epispore than *P. tasmanica*.

49. Puccinia fodiens n. sp. (Fig. 67.)

0, I, Unknown.

II. Uredosori amphigenous, seated on discoloured spots, scattered or in more or less circinnate groups, circular, bullate, pulverulent, cream-coloured, long covered by the tomentum of the leaf, up to 5 mm. diam. Spores subglobose to globose, frequently obovate, 25–38 × 26–29 mmm.; epispore sparsely and coarsely echinulate, 3–4 mmm. thick, hyaline, cell-contents pallid yellow, with 2–3 scattered germ-pores on one face.

III. Teleutosori similar to the uredosori but chestnut-brown. Spores broadly elliptical, 40–55 × 28–35 mmm.; apex obtusely acuminate, often rounded, thickened up to 10 mmm., base rounded, seldom attenuate, both cells same size and colour; not constricted at the septum; epispore punctate, 3–4 mmm. thick, chestnut-brown, cell-contents granular, nuclei

conspicuous; pedicel deciduous, hyaline, delicate, up to 30 × 8 mmm.; germ-pore of the upper cell apical or one-third below apex, conspicuous, basal pore immediately below or one-third way below the septum, conspicuous.

Host: *Celmisia rigida* (T. Kirk) Cockayne. On leaves. Herb. No. 376. II, III. Botanical Gardens, Queenstown (Otago), *G. H. C.* 3 Dec., 1919. (Type.)

The host is an endemic species. The sori are covered by the dense tomentum which clothes the leaf-surfaces. Teleutospores are rare, and occur in the same sori as the uredospores.

Characterized by the thickened apex, punctate epispore, and large size of the teleutospores.

50. Puccinia hectorensis n. sp. (Fig. 68.)

0. Unknown.

I. Aecidia hypophyllous and on petioles, scattered or in irregular groups, sparse, dingy yellow. Peridia cylindrical, standing above the leaf-surface 1 mm. or more, up to 0·5 mm. diam., cream-coloured, margins erect, lacerate. Spores polygonal, 30–40 × 20–30 mmm.; epispore dingy yellowish-brown, 2 mmm. thick, densely and finely verruculose.

III. Teleutosori hypophyllous, ochraceous, scattered, circular, up to 1·5 mm. diam., compact, long covered by the dense tomentum of the leaf. Spores linear-oblong, 100–140 × 20–32 mmm.; apex bluntly rounded, not or scarcely thickened, base subattenuate, lower cell somewhat narrower than upper, cell-contents granular, pale orange; slightly constricted at the septum; epispore smooth, 1·5–2 mmm. thick, hyaline; pedicel persistent, hyaline, up to 100 × 10 mmm., continuous with the spore; germ-pore of upper cell apical, obscure, basal pore immediately below the septum, obscure.

X. Mesospores common, 60–85 × 16–24 mmm.; apex bluntly rounded.

Host: *Senecio Bidwillii* Hook. f. On leaves and petioles. Herb. No. 495. I, III. Mount Dennan, Tararua Mountains (Wellington), 1,200 m., *E. H. Atkinson!* 7 Jan., 1922. (Type.)

The host is endemic, and is confined to the mountain regions of both Islands (Cheeseman, 1906, p. 383). The teleutospores germinate immediately they reach maturity. This species shows a general resemblance to *Puccinia novae-zelandiae* G. H. Cunn., but is readily distinguished by the linear-oblong spores, which attain a length of 140 mmm.

51. Puccinia Hypochoeridis Oudemans. (Fig. 69.)

Oud., in *Nedler. Kruidk. Archief.*, vol. 2, ser. 1, p. 175, 1872.

Puccinia Microseris McAlp., *Agr. Gaz. N.S.W.*, vol. 6, p. 757, 1895.

0, I. Unknown.

II. Uredosori amphigenous, scattered, pulverulent, circular or elliptical, up to 1·5 mm. diam., chestnut-brown, surrounded by the ruptured epidermis. Spores globose to elliptical, 20–28 × 18–25 mmm.; epispore densely and minutely verruculose, chestnut-brown, 1·5–2 mmm. thick, cell-contents granular, with 2 usually papillate equatorial germ-pores.

III. Teleutosori amphigenous, scattered, circular or elliptical, up to 1 mm. diam., chocolate-brown, pulvinate, compact, surrounded by the ruptured epidermis. Spores elliptical or subclavate, 28–42 × 18–25 mmm.; apex rounded, not thickened, base attenuate, commonly rounded, both

cells same colour, lower slightly narrower, cell-contents granular, nuclei evident; slightly or not constricted at the septum; epispore minutely and densely verruculose, chestnut-brown, 1·5–2 mmm. thick; pedicel persistent, hyaline, delicate, up to 42 × 6 mmm.; germ-pore of the upper cell apical or frequently one-third way down the side, conspicuous, basal pore one-half to two-thirds way below septum, conspicuous, both usually papillate.

Host: *Hypochoeris glabra* L. On leaves and stems. Herb. No. 440. II, III. Dunstan Mountains (Otago), 600 m., *W. D. Reid!* 5 Dec., 1921.

Distribution: Australia; North America; Europe; Chile; Siberia.

The host is an introduced plant, and is a common weed in pastures. The epispore is seen to be distinctly verruculose when the teleutospores are mounted dry and examined. This species is difficult to separate from several closely related species which occur on related genera of the host plant; in fact, many of these so-called species are separated on biological distinctions alone, so that determination of many is dependent on determination of the host. The verruculose epispore, rounded apex, and somewhat clavate form of the teleutospore characterizes this and several closely related species; correct determination of the host fixes the species.

52. **Puccinia Lagenophorae** Cooke. (Fig. 70.)

Cke., *Grev.*, vol. 13, p. 6, 1884.

Puccinia Hypochoeridis McAlp., *Proc. Roy. Soc. Vic.*, vol. 7, p. 217, 1894.
P. Macalpini Syd., *Mon. Ured.*, vol. 1, p. 100, 1902.

0. Spermogones amphigenous, associated with the aecidia, on pale-yellow spots, immersed, minute, honey-coloured.

I. Aecidia amphigenous, scattered or more commonly in groups on pale-yellow spots. Peridia up to 200–240 mmm. diam., cupulate, margins white, slightly revolute, laciniate. Spores subglobose to shortly elliptical, 17–19 × 14 mmm.; epispore hyaline, finely and densely verruculose, 1 mmm. thick, cell-contents pallid yellow.

III. Teleutosori amphigenous and caulicolous, chestnut-brown, circular or elliptical, on stems scattered or aggregated into irregularly circular groups, pulvinate, compact, up to 2 mm. diam., surrounded by the ruptured epidermis. Spores subclavate, seldom elliptical, 34–46 × 15–22 mmm: apex rounded, truncate, or often bluntly acuminate, thickened up to 7 mmm, more deeply coloured than rest of spore, base attenuate, basal cell narrower and somewhat longer and lighter in colour than upper, cell-contents vacuolate; constricted at the septum; epispore smooth, 2·5–3 mmm. thick in upper cell, 2–2·5 mmm. in lower, chestnut-brown; pedicel persistent, tinted, stout, up to 35 × 8 mmm., continuous with spore; germ-pore of the upper cell apical, obscure, basal pore immediately beneath the septum, obscure.

X. Mesospores common, clavate to obovate, 32–38 × 17–22 mmm.; apex thickened.

Hosts:—

Lagenophora Barkeri T. Kirk. On leaves and stems. Herb. Nos. 177, 300. I, III. Porter River (Canterbury), *T. Kirk!* 21 Feb., 1881.

Lagenophora petiolata Hook. f. On leaves. I, III. Mount Judah (Otago), 1,000 m., *W. D. Reid!* 14 Dec., 1921.

Lagenophora pumila (Forst. f.) Cheeseman. On leaves, petioles, and stems. I. Bravo Island, *T. Kirk!* Dunstan Mountains (Otago), 500 m., *A. H. Cockayne!* 6 Feb., 1921. I, III. Table Bay, 840 m.; Dunstan Mountains (Otago), *W. D. Reid!* April, Dec., 1921.

Distribution: Australia; Tasmania.

All three hosts are endemic, *L. Barkeri* being confined to the South Island (Cheeseman, 1906, p. 272–73). A large number of mesospores are present in the sori. Although in the original description Cooke describes uredospores, neither McAlpine nor I have been able to find them, so they have been omitted from the above description. There are no type specimens of this species in the Kew Herbarium, so that the matter must remain at issue. The teleutospore-measurements given above differ considerably from those given by McAlpine (1906, p. 162), his measurements being 36–63 × 15–25 mmm.

53. Puccinia Lapsanae Fuckel. (Fig. 71.)

Fcl., *Symb. Myc.*, p. 53, 1869.

Aecidium Lapsanae Schultz, *Prodr. Fl. Stangard.*, p. 454, 1806. *A. compositarum Lapsanae* Purton: Cke., in *Jour. Bot.*, vol. 2, p. 38, 1864. *Trichobasis Lapsanae* Cke., *Micr. Fungi*, ed. 4, p. 224, 1865. *Puccinia Lampsanae* Fcl., in *Sacc., Syll.*, vol. 7, p. 607, 1888. *Dicaeoma Lapsanae* (Schultz) Kuntze, *Rev. Gen.*, vol. 3, p. 469, 1898.

0. Spermogones amphigenous, in small groups on discoloured spots, honey-coloured.

I. Aecidia amphigenous, seated on purplish, inflated spots, and on veins and petioles, arranged in circular or linear groups. Peridia explanate, margins reflexed, white, deeply and irregularly laciniate. Spores globose, elliptical, or polygonal, 15–28 × 13–26 mmm.; epispore hyaline, minutely verruculose, 1–1·5 mmm. thick, cell-contents orange.

II. Uredosori amphigenous, cinnamon-brown, circular, sometimes irregular, scattered, seldom confluent, pulverulent, 0·25–0·5 mm. diam., surrounded by the ruptured epidermis. Spores subglobose or elliptical, 18–23 × 15–19 mmm.; epispore delicately and sparsely echinulate, 1·5 mmm. thick, cinnamon-brown, with 2 frequently papillate equatorial germ-pores on one face.

III. Teleutosori amphigenous, chocolate-brown, circular, scattered, pulverulent, 0·25–0·5 mmm. diam., surrounded by the ruptured epidermis. Spores elliptical, subglobose, or obovate, 20–32 × 17–25 mmm.; apex rounded, not thickened, base rounded, both cells same size and colour, cell-contents granular; slightly or not constricted at the septum; epispore minutely verruculose, 1·5–2 mmm. thick, chestnut-brown; pedicel deciduous, hyaline, up to 30 × 5 mmm.; germ-pore of upper cell apical, or frequently one-quarter way down side, basal pore one-third below septum, both conspicuous and frequently papillate.

X. Mesospores rare, obovate, or elliptical, 16–22 × 17–20 mmm.; apex rounded, not thickened.

Host: *Lapsana communis* L. On leaves. Herb. No. 185. II, III. Motueka (Nelson), *G. H. C.* 28 Jan., 1920. II. Levin (Wellington), *G. H. C.* 1 Mar., 1920. II, III. Palmerston North (Wellington), *R. Waters!* 27 Jan., 1921.

Distribution: Europe; North America; Japan; Syria.

The aecidia have not been collected in New Zealand. The host is an introduced plant, and is a common weed in waste places throughout

the warmer parts of New Zealand. The epispore is seen to be minutely verruculose when the teleutospores are mounted dry and examined. Closely resembles *P. Hypochoeridis* (see remarks under this species), but differs chiefly in the smaller teleutospores and presence of aecidia.

54. Puccinia novae-zelandiae n. sp. (Fig. 72.)

0. Spermogones epiphyllous, sparse, scattered, honey-brown.

I. Aecidia epiphyllous, sparsely arranged in scattered groups on discoloured circular areas. Peridia tubular, standing above the leaf-surface 1 mm., 300 mmm. diam., becoming irregular in shape, margins white, strongly revolute, deeply and irregularly laciniate, finally coming to resemble the form genus *Roestelia*. Spores polygonal, elliptical, or obovate, 25–35 × 15–22 mmm.; epispore minutely and densely verruculose, 1·5–2 mmm. thick, hyaline, cell-contents lemon-yellow.

III. Teleutosori hypophyllous, reddish-orange, circular to elliptical, scattered, pulverulent, up to 0·5 mm. diam., deeply buried in the dense tomentum of the under-surface of the leaf. Spores elliptical to oblong-clavate, 55–93 × 25–37 mmm.; apex rounded, not thickened, base rounded, seldom subattenuate; basal cell usually the same size as upper, rarely narrower; constricted at the septum; epispore smooth, 2–3 mmm. thick, hyaline, cell-contents old-gold colour, granular; pedicel persistent, hyaline, stout, up to 95 × 12 mmm.; germ-pore of upper cell apical, conspicuous, basal pore immediately below the septum, conspicuous.

X. Mesospores common, obovate to pyriform, 45–55 × 30–37 mmm.; apex rounded, not thickened, cell-contents old-gold colour.

Host: *Olearia Forsteri* Hook. f. On leaves. Herb. No. 310. I, III. Coast, Pencarrow (Wellington), *E. H. Atkinson!* 10 Feb., 1921. (Type.)

The host is endemic, and fairly widespread over both Islands (Cheeseman, 1906, p. 292). The spores germinate immediately on reaching maturity, and in some of the sori it is difficult to find a spore that has not germinated. The basidia are of the same colour as the cell-contents, and measure 100 × 20 mmm., the sterigmata may attain a length of 15 mmm., and the basidiospores are obovate and measure 20 × 15 mmm (fig. 2). The teleutospores somewhat resemble those of *Puccinia Oleariae* McAlp., but the presence of aecidia and the absence of uredospores, besides numerous differences in the teleutospores, serve to separate the two. I am indebted to Mr. L. Rodway, Government Botanist, Tasmania, and to Mr. C. C. Brittlebank, Plant Pathologist, Melbourne, for specimens of *P. Olearíae*. This rust is characterized by the very large size of the teleutospores, hyaline smooth epispore, and old-gold cell-contents.

55. Puccinia obtegens Tulasne. (Fig. 73.)

Tul., in *Ann. Sci. Nat.*, ser. 4, vol. 2, p. 87, 1854.

Uredo suavolens Pers., *Obs.*, vol. 2, p. 24, 1799. *U. punctiformis* Strauss, in *Wett. Ann.*, vol. 2, p. 103, 1810. *Caeoma obtegens* Link., *Obs.*, vol. 2, p. 27, 1816. *Trichobasis suavolens* Lev.: Cooke, in *Handbk*, p. 530, 1871. *Puccinia suavolens* Rostr., in *Forhandl. Skand. Naturf.* vol. 2, p. 339, 1874.

0. Spermogones amphigenous, scattered over the whole leaf-surface, honey-coloured, sweet-scented.

II. Uredosori hypophyllous, cinnamon-brown, at first scattered, 1 mm. diam., crowded, circular, becoming confluent and covering the entire under-surface of the leaf, pulverulent, surrounded by the ruptured epidermis.

Spores subglobose or broadly elliptical, rarely obovate, 22–30 × 18–28 mmm.; epispore delicately and somewhat closely echinulate, 1·5 mmm. thick, up to 3 mmm. above pedicel, cinnamon-brown, with 2–3 scattered germ-pores on one face.

III. Teleutosori hypophyllous, at first minute, 1 mm. diam., circular, scattered, becoming confluent, finally whole leaf-surface becoming covered, chestnut-brown, pulverulent. Spores elliptical or oblong, 28–40 × 18–25 mmm.; apex rounded, not thickened, base rounded, basal cell

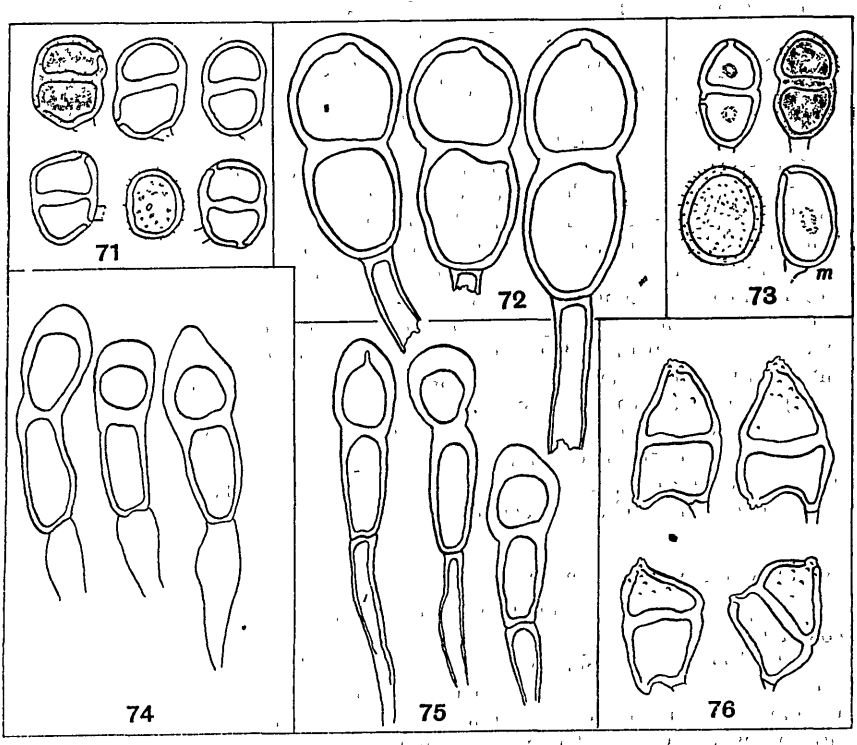


FIG. 71.—*Puccinia Lapsanae* Fcl. Uredo- and teleuto-spores from *Lapsana communis* L.
FIG. 72.—*Puccinia novae-zelandiae* sp. nov. Teleutospores from *Olearia Forsteri* Hook. f. × 325.
FIG. 73.—*Puccinia obtegens* Tul. Uredo- and teleuto-spores from *Cnicus arvensis* Hoffm.
FIG. 74.—*Puccinia pounamu* sp. nov. Teleutospores from *Senecio southlandicus* Cockayne.
FIG. 75.—*Puccinia tasmanica* Diet. Teleutospores from *Senecio lautus* Forst. f.
FIG. 76.—*Gymnoconia Peckiana* (Howe) Trotter. Teleutospores from *Rubus villosus* Ait.
Camera-lucida drawings by author. All, with exception of fig. 72, × 500.
m = mesospore.

same size as upper; slightly constricted at the septum; epispore verruculose, 1–1·5 mmm. thick, chestnut-brown, cell-contents granular, nuclei prominent; pedicel deciduous, hyaline, short, up to 45 × 6 mmm.; germ-pore of upper cell apical, or frequently obliquely placed, basal pore immediately below septum, both conspicuous.

X. Mesospores uncommon, elliptical, 22–28 × 17–22 mmm.; rounded, or sometimes truncate at the apex, not thickened.

Host: *Cnicus arvensis* Hoffm. On leaves and stems. Herb. No. 221. II, III. Weraroa (Wellington), *A. H. Cockayne!* 9 May, 1919. Roxburgh (Otago), *J. Fleming!* 17 Jan., 1921. Turakina (Wellington), *S. A. Cunningham!* 4 Dec., 1921.

Distribution: Europe; Siberia; North America; Japan; Australia.

The host is introduced, and is a troublesome weed throughout the agricultural areas of New Zealand. The rust is of considerable economic importance, as once it has become established in a patch of thistles it persists year after year and prevents seed-formation in the flowering-heads. Infected plants may readily be recognized, as they become etiolated and lighter in colour than normal plants.

There are two distinct phases in the life-cycle of this species. Early in the spring primary uredosori arise from basidiospores produced from the previous season's teleutospores. These sori cover the greater part of the lower surface of the leaf, and the mycelium permeates the whole plant. This phase is accompanied by spermogones, which are said to give off a strong and pleasant odour. From the primary uredospores arise secondary sori producing both uredo- and teleuto-spores. These secondary sori are scattered and their mycelium is localized, consequently but little damage is done to the plant. This phase is not accompanied by spermogones. Infection from the teleutospores of these secondary sori occurs the following spring, when the young shoots and plants are infected. At one time it was believed that this rust was perpetuated by means of hybernating mycelium in the rhizomes; later investigations have disproved this theory. The verruculose epispore, non-thickened apex, and regular, elliptical shape of the teleutospore characterize this species.

56. Puccinia pounamu n. sp. (Fig. 74.)

0. Spermogones hypophyllous, sparse, scattered, immersed, honey-coloured.

III. Teleutosori amphigenous, chiefly hypophyllous, arranged in scattered groups on discoloured areas which are usually surrounded by a yellow margin, circular, minute, 0·5 mm. diam., pulvinate, compact, chestnut-brown, surrounded by the ruptured epidermis. Spores elongate-clavate or elliptical, 47–65 × 14–29 mmm.; apex rounded, seldom bluntly acuminate, thickened up to 10 mmm., base attenuate, lower cell narrower and somewhat longer than upper; slightly or not constricted at the septum; epispore smooth, tinted brown, almost hyaline, 2–2·5 mmm. thick; pedicel persistent, hyaline, stout, up to 50 × 12 mmm., continuous with spore; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

Host: *Senecio southlandicus* Cockayne. On leaves. Herb. No. 426. III. Greenstone Valley (Otago), 500 m., *W. D. Reid!* 5 April, 1921. (Type.)

The host is endemic.

The teleutospores germinate immediately on reaching maturity. A rather conspicuous feature is the presence, in a number of spores, of an inflated pedicel (fig. 74).

Characterized by the smooth epispore, thick apex, attenuate base, and stout persistent pedicel of the teleutospore.

57. Puccinia tasmanica Dietel. (Figs. 4, 75.)

Diet., *Ann. Myc.*, vol. 1, p. 535, 1903.

0. Spermogones amphigenous and caulicolous, erumpent, scattered, honey-coloured.

I. Aecidia amphigenous and caulicolous, forming inflated orange spots on leaves, and linear inflated and distorted areas up to 10 mm. or more in length on the stems, scattered or more commonly closely aggregated. Peridia cupulate, up to 300 mmm. diam., margins tinted yellow, strongly revolute, irregularly laciniate. Spores subglobose to polygonal, 14–17 × 12–15 mmm.; epispore minutely and densely verruculose, 1–1·5 mmm. thick, hyaline or tinted yellow, cell-contents orange.

III. Teleutosori caulicolous, less commonly amphigenous, frequently intermixed with aecidia, forming linear distorted areas up to 2 cm. in length, black, pulvinate, compact, for a long time covered, finally becoming exposed by the epidermis falling away in irregular shreds. Spores elongate-clavate, 40–60 × 13–28 mmm.; apex bluntly rounded, commonly truncate, seldom acuminate, at times oblique, thickened up to 14 mmm., darker in colour, base attenuate, basal cell longer, narrower, and lighter in colour than the upper; constricted at the septum; epispore smooth, up to 3 mmm. thick in upper cell, 1·5–2 mmm. in lower, chestnut-brown, cell-contents vacuolate; pedicel persistent, tinted, stout, up to 60 × 11 mmm., continuous with spore; germ-pore of upper cell apical, obscure, basal pore immediately below septum, obscure.

X. Mesospores common, elliptical to obovate, 30–42 × 12–16 mmm.; apex rounded, thickened.

Hosts :—

Senecio lautus Forst. f. On leaves, stems, peduncles, and involucral bracts. Herb. Nos. 181, 293, 404. I, III. Wellington Heads, *E. H. Atkinson!* 11 April, 1920. I. Cashmere Hills (Canterbury), 400 m., *W. D. Reid!* 31st July, 1921. Seatoun (Wellington), *G. H. C.* 27 Jan., 1921.

Senecio vulgaris L. On leaves and stems. I, III. Weraroa (Wellington). 21 Oct., 1919. I. Kelburn (Wellington), *G. H. C.* Jan., June, Oct., Nov., 1921.

Distribution: Australia; Tasmania.

One host is indigenous and widespread, the other is a weed common in gardens and waste places. One commonly sees "groundsel" plants killed outright by the aecidial stage of this rust. Although plants of *S. lautus* attacked by the aecidia are distorted and stunted, they are seldom killed outright. This species differs from *P. Senecionis* Lib. in the thickened apex, larger size, and persistent pedicels of the teleutospores.

4. GYMNOCONIA Lagerheim.

Lagerh., *Tromosoe Mus. Aarsh.*, vol. 16, p. 140, 1894.

Autoecious. Cycle of development includes 0, I, III.

0. Spermogones columnar, erumpent, aparaphysate, honey-coloured.

I. Caeomata without peridia, aparaphysate; large, erumpent, indefinite. Spores catenulate, commonly polygonal; epispore verruculose, hyaline.

III. Teleutosori erumpent, pulverulent, definite. Teleutospores two-celled, borne singly on distinct pedicels; epispore smooth, or with a few small warts, coloured; germ-pores one to a cell, papillate.

New Zealand species, 1 (introduced).

This genus is separated from *Puccinia* on account of the peridia being absent from the aecidia, and because of the absence of uredospores. The teleutospores are peculiar in that they are more or less triangular, the base being at one angle formed by the attachment of the pedicel; the other angle being formed by the protrusion of the epispore into a short projection, at the end of which is the germ-pore.

1. **Gymnoconia Peckiana** (Howe) Trotter. (Fig. 76.) Rosaceae (1).

A. Trotter, *Fl. Ital. Crypt.*, Pars. 1 Fungi., Fasc. 7, Ured., p. 337, 1910.

Uredo interstitialis Schlecht., *Horae Phys., Berol.*, p. 96, 1820. *Aecidium nitens* Schw., *Schr. Nat. Ges. Leipsig*, vol. 1, p. 69. 1822. *Caeoma luminatum* Link., in Wild., *Sp. Pl.*, vol. 6, p. 61. 1825. *Puccinia Peckiana* Howe: Peck. *Ann. Rep. N.Y. State Mus.*, vol. 23, p. 57, 1872. *P. tripustulata* Peck, *Ann. Rep. N.Y. State Mus.*, vol. 24, p. 91, 1872. *Caeoma nitens* Burrill, *Bull. Ill. Lab. Nat. Hist.*, vol. 2, p. 220, 1885. *Puccinia interstitialis* Tranz., *Hedw.*, vol. 32, p. 259, 1893. *Gymnoconia interstitialis* (Schlecht.) Lagerh., *Tromosoe Mus. Aarsh.*, vol. 16, p. 140, 1894. *Dicaeoma tripustulatum* Kuntze, *Rev. Gen.*, vol. 3, p. 467, 1898. *Kunkelia nitens* Arth., *Bot. Gaz.*, vol. 63, p. 501, 1917.

0. Spermogones amphigenous, scattered, columnar, honey-coloured, conspicuous.

I. Caeomata amphigenous, chiefly hypophyllous and caulicolous, scattered or more frequently crowded, up to 1·5 mm. diam., erumpent, orange-yellow, surrounded by the ruptured epidermis. Spores globose to polygonal, 20–30 × 17–24 mmm.; epispore 1–1·5 mmm. thick, hyaline, densely verruculose, cell-contents bright orange, germ-pores scattered, numerous. obscure.

III. Teleutosori hypophyllous, on discoloured spots, scattered, rarely confluent, circular, minute, up to 0·25 mm. diam., pulverulent, chestnut-brown, soon naked. Teleutospores irregularly triangular, seldom elliptical, 35–45 × 20–26 mmm.; apex bluntly acuminate, seldom rounded, not thickened, but crowned with 1 or several hyaline papillae, base very irregular in shape, attenuate, bluntly rounded or coarsely retuse, upper cell usually somewhat triangular, basal cell distorted near the pedicel by a protrusion of the wall; epispore covered with a few coarse warts, more prominently near the germ-pores, 1–1·5 mmm. thick, golden-brown, cell-contents coarsely granular; slightly or not constricted at the septum; pedicel deciduous. hyaline, fragile, up to 60 × 5 mmm; germ-pore of the upper cell apical, conspicuous, basal pore from half-way to two-thirds below septum, usually at end of protrusion of epispore, conspicuous, both usually papillate.

Host: *Rubus fruticosus* L. On leaves and stems. Herb. No. 246. I. Tokomaru (Wellington), *G. H. C.* 6 Dec., 1920. Auckland, *G. H. C.* 2 Mar., 1921. Helensville (Auckland), *E. Bruce Levy.* Feb., 1921.

Distribution: North America; Europe; Asia.

In North America two biological forms of this rust occur. The caeomaspores of one form on germination produce short basidia on which basidiospores are produced; these basidiospores on coming in contact with the host give rise to further caeomata; so that the caeomaspores appear to function as teleutospores. The caeomaspores of the second form on germination produce germ-tubes which, on the host, produce teleutosori.

LATIN DESCRIPTIONS.

1. **Uromyces Discariae** sp. nov. (Fig. 15, and Plate 77, fig. 1.)

0. Spermagoniis hypophyllis, aecidis praecessis, confertis, saepe circinatis, minutis, immersis, subflavis.

I. Aecidiis hypophyllis, in flavis maculis quae desuper cerri possunt solide confertis. Peridiis cylindraceis, super superficiem exstitis a 1 mm., luteis, marginibus erectis, hyalinis, dentatis. Aecidiosporis polygoniis vel globosis, 26–32 × 22–26 mmm.; episporio hyalino, 1·5–2 mmm. crasso, dense minuteque verrucoso, contentu luteo, vacuolato.

III. Soris teleutosporiferis hyophyllis, raris, in maculis flavis, spadicibus, pulvinatis, compactis, rotundis v. communiter ellipticis, ad 2 mm. longis, tectis. Teleutosporis ellipticis v. subglobosis, incompositis, 23–33 × 15–21 mmm.; apice acuminato, vel rustice rotundato, crassis ad 10 mmm., basi abrupte attenuato, raro rotundato, nucleo conspicuo; pedicello persistente, tincto, ad 80 × 5 mmm.; foramine germinis apicale, conspicuo.

Hab.: In foliis vivis *Discariae toumatou* Raoul. Queenstown, Otago, New Zealand. *W. D. Reid.*

2. **Uromyces otakou** sp. nov. (Fig. 7.)

0, I. Incognitis.

II. Uredosoris epiphyllis, raris, raro linearibus, ellipticis, ad 2 mm. longis, luteis, pulverulentibus, epidermide rupta cinctis. Uredosporis globosis v. subglobosis, 20–30 mmm. crassis; episporio dense minuteque verrucusco, 1–1·5 mmm. crasso, hyalino, contentu luteo, cum 5–8 raris foraminibus germinis.

III. Soris teleutosporiferis epiphyllis, raris, raro confluentibus, linearibus, spadicibus, ad 3 mm. longis, pulvinatis, compactis, epidermide rupta cinctis. Teleutosporis obovatis, 24–30 × 19–23 mmm.; apice rotundo, raro rustice acuminato, crassis ad 12 mmm., basi subattenuato, saepe rotundato; episporio leve, crasso 2–5·5 mmm., castaneo; pedicello persistente, tincto, ad 60 × 8 mmm.; foramine germinis apicale, obscuro.

Hab.: In foliis, vaginisque *Poae caespitosae* Spreng. Otago, New Zealand. *W. D. Reid.*

3. **Puccinia Allanii** sp. nov. (Fig. 58.)

0. Spermagoniis amphigenis, sparsis, aliquantum aecidiis immixis, subflavis.

I. Aecidiis amphigenis, in maculis decolaratis solide confertis, in subrotundis catervis, flavis. Peridiis cupulatis, marginibus expansis, sed non revolutis, laceratis, albis. Aecidiosporis polygoniis, saepe subglobosis, 12–18 mmm. latis; episporio verruculoso, 1 mmm. crasso, hyalino, contentu luteo.

III. Soris teleutosporiferis hypophyllis, aecidiis immixis, minutis, 0·25–0·5 mm. latis, rotundis, pulvinatis, compactis, castaneis, epidermide rupta cinctis. Teleutosporis ellipticis, communiter subclavatis, 35–55 × 18–26 mmm.; apice rotundato, saepe rustice acuminato, incrassato ad 10 mmm., basi attenuato, cellula superiore fusciore latioreque quam inferiore; ad septum constricto; episporio leve, castaneo, crasso 2–3 mmm.; pedicello persistente, tincto, ad 50 × 10 mmm.; foramine germinis cellulae superiore apicale, conspicuo, foramine basali statim infra septum, obscuro.

Hab.: In foliis vivis *Senecionis lagopi* Raoul. Banks Peninsula, Canterbury, New Zealand. *H. H. Allan.*

4. **Puccinia Atkinsonii** sp. nov. (Fig. 59.)

0. Spermagoniis hypophyllis, aecidiis immixis, minutis, immersis, brunneo-subflavis.

I. Aecidiis hypophyllis, in magnis catervis in maculis detorsis quae desuper cerni possunt solide confertis, ad 25 mm. longis, rotundis v. linearibus, luteis. Peridiis immersis, marginibus solis conspectis, ellipticis, ad 800 mmm. latis × 450 mmm. altis, marginibus solidis, erectis. Aecidiosporis sub globosis, ellipticis, saepe lenticularibus cum apiculo longo hyalino, 25–35 × 15–22 mmm.; episporio dense minuteque verrucoso, 2 mmm crasso, hyalino, contentu rubro-luteo, granuloso.

III. Soris teleutosporiferis hypophyllis, in minutis nigro-brunneis maculis, desuper inspectis, nigro-spadicibus fere nigris, rotundis, raris, primum tomento denso folii tectis, ad extremum erumpentibus pulverulentibusque, ad 0·5 mm. latis. Teleutosporis late ellipticis, 40–65 × 20–35 mmm.; apice retuso, non saepe papillato, incrassato ad 7 mmm. necne, basi rotundato, non saepe attenuato, cellulis similibus; ad septum leniter constricto; episporio leve, 2·5–3 mmm. crasso, pallido-castaneo, contentu vacuolato: pedicello deciduo, hyalino, ad 45 × 8 mmm.; foramine germinis cellulae superioris apicale, v. variato inter apicem septumque, foramine basali ferme $\frac{1}{3}$ infra septum, cellulis conspicuis et primum papillatis, inde papillis concidentibus notam in episporio super foramen germinis facientibus.

X. Mesosporis raris, subglobosis, ellipticis v. obovatis, 35–55 × 38–45 mmm.

Hab.: In foliis vivis *Oleariae excorticatae* Buch. Mount Hector, Wellington, New Zealand. *E. H. Atkinson.*

5. **Puccinia Cockaynei** sp. nov. (Fig. 51.)

0. Spermagoniis amphigenis, in maculis flavis, uredosoris immixis v. cinctis, immersis, subflavis.

II. Uredosoris amphigenis, castaneis, rotundis v. ellipticis, minutis, ad 1 mm. latis, raris, pulverulentibus, bullatis, rupta epidermide cinctis. Uredosporis subglobosis, ellipticis v. communiter obovatis, 20–32 × 17–26 mmm.; episporio minute sparseque echinulato, 2 mmm. crasso, cinnamomeo, cum foramine germinis uno, conspicuo.

III. Soris teleutosporiferis amphigenis, praecipue hypophyllis, spadicibus, rotundis v. ellipticis, ad 1 mm. latis, raris, pulverulentibus, rupta epidermide cinctis. Teleutosporis clavatis, non saepe ellipticis, 30–38 × 18–24 mmm.; apice rustice rotundato, saepe rustice attenuato, ad 6 mmm. incrassato, basi attenuato, non saepe rotundato, cellula basali angustiore pallidioreque quam superiorem; ad septum paulum constricto; episporio castaneo, leve, 1·5–2 mmm. crasso, contentu vacuolato, nucleis claris; pedicello deciduo, hyalino, fragile, ad 50 × 8 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali statim infra septum, conspicuo, saepe papillato.

X. Mesosporis raris, subglobosis v. ellipticis, 18–22 × 16–20 mmm.

Hab.: In foliis vivis *Gentianae corymbiferae* T. Kirk et *G. Griesbachii* Hook. f. Queenstown, Otago, New Zealand. *E. H. Atkinson.*

6. **Puccinia contegens** sp. nov. (Fig. 35.)

0. Spermagoniis amphigenis, sparsis, aecidiis immixis, subflavis.

I. Aecidiis hypophyllis, confertis, flavis. Peridiis immersis, marginibus incurvis et partim epidermide tectis. Aecidiosporis polygonis v. ellipticis, 17–26 × 15–18 mmm.; episporio hyalino, 2 mmm. crasso, dense minuteque verruculoso, contentu luteo, vacuolato.

III. Soris teleutosporiferis amphigenis, castaneis, pulverulentibus, primum raris, rotundis et rupta epidermide cinctis, inde confluentibus. Teleutosporis ellipticis vel subclavatis, 30–45 × 16–23 mmm.; apice rotundato, saepe obliquiter acuminato, non incrassato, basi rotundato, non saepe attenuato, cellulis similibus; leniter ad septum constrictis; episporio 1–1·5 mmm. crasso, reticulato, castaneo, contentu vacuolato; pedicello persistente, hyalino, fragile, ad 60 × 7 mmm., saepe lateraliter affixo; foramine germinis superioris cellulae apicale, conspicuo, foramine basali $\frac{2}{3}$ infra septum, conspicuo, cellulis saepe papillatis.

X. Mesosporis raris, obovatis, v. subglobosis, circiter 22 × 18 mmm.; episporio reticulato, 1 mmm. crasso, castaneo.

Hab.: In foliis vivis *Ranunculi lappacei* Smith et *R. multiscapi* Hook. f. Canterbury, New Zealand. *W. D. Reid.*

7. Puccinia cuniculi sp. nov. (Fig. 46.)

0. Spermagoniis amphigenis, aecidiis immixis, sparsis, raris, minutis, subflavis.

I. Aecidiis hypophyllis, caulicolisque, dense confertis, in foliis in orbibus in catervis inflatis, aliquantum positis, in maculis decolaratis quae desuper cerni possunt, in caulibus petiolibusque in catervis linearibus inflatisque ad 10 mm. longis. Peridiis cupulatis, marginibus expansis, non revolutis, albis, profunde et incomposite laciniatis. Aecidiosporis subglobosis v. polygoniis, 20–22 mmm. crassis; episporio minute denseque verruculoso, 4 mmm. crasso, hyalino, contentu pallido-flavo.

II. Uredosoris hypophyllis, pallido-flavis, raris, pulverulentibus, ad 0·5 mm. latis, ellipticis v. rotundis, rupta epidermide cinctis. Uredosporis obovatis v. ellipticis, 26–30×19–25 mmm.; episporio leniter et aliquantum rustice echinulato, 3 mmm. crasso, hyalino, contentu flavo, cum 3–4 foraminibus germinis, indistinctis.

III. Soris teleutosporiferis hypophyllis, minutis, lenticularibus, spadicibus pulverulentibus, 0·5 mm. longis, diu tectis, ad extremum rupta epidermide expositis. Teleutosporis ellipticis v. subclavatis, 35–45 × 21–26 mmm.; apice rotundato, leniter incrassato, basi attenuato saepe rotundato, cellula basali leniter angustiore quam superiorem; ad septum leniter constricto; episporio leve, 2 mmm. crasso, castaneo, contentu granuloso, nucleis conspicuis; pedicello persistente, hyalino, fragile, ad 50 × 5 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali $\frac{1}{2}$–$\frac{2}{3}$ infra septum, conspicuo, cellulis saepe papillatis.

Hab.: In foliis vivis, caulis, petiolibusque *Angelicae Gingidium* Hook. f. Canterbury, New Zealand. *E. H. Atkinson.*

8. Puccinia egmontensis sp. nov. (Fig. 65.)

0. Spermagoniis amphigenis, in catervis irregularibus in maculis inflatis congestis, erumpentibus, raris vel congestis, pallido-flavis.

III. Soris teleutosporiferis amphigenis, in catervis irregularibus in maculis flavis inflatis congestis, spermagoniis cinctis, circularibus, vel irregulariter ellipticis, saepe circinnatis, ad 2 mm. latis, pulvinatis, compactis, nigris, epidermide rupta cinctis. Teleutosporis clavatis, 55–65 × 15–22 mmm.; apice rustice acuminato, non saepe acuminato, ad 10 mmm. incrassato, colore fusciore, basi attenuato, cellula basali longiore et angustiore et pallidiore quam superiorem, contentu granuloso, nucleis conspicuis; ad septum paullo constrictis; episporio leve, 1·5–2 mmm. crasso in superiore cellula, 1–1·5 mmm. in inferiore, castaneo-brunneo; pedicello persistente, hyalino, 50 × 5 mmm., in sporo se inclinato; foramine germinis superioris cellulae apicale, obscuro, foramine basali statim infra septum, obscuro.

X. Mesosporis vulgaribus, ellipticis vel fusoideis, 30–40 × 12–16 mmm.; apice acuminato.

Hab.: In foliis vivis *Celmisiae glandulosae* Hook. f. Mount Egmont, New Zealand. *W. D. Reid, N. R. Foy.*

9. Puccinia fodiens sp. nov. (Fig. 67.)

0, I. Incognitis.

II. Uredosoris amphigenis, in maculis decoloratis, raris vel in aliquantum circinnatis catervis, rotundis, bullatis, pulverulentibus, subflavis, ad 4 mm. latis, diu tomento folii tectis. Uredosporis subglobosis v. globosis, saepe obovatis, 25–35 × 26–29 mmm.; episporio ferme sparse rusticeque echinulato, 3–4 mmm. crasso, hyalino, contentu flavo, cum 2–3 foraminibus germinis raris.

III. Soris teleutosporiferis uredosoris similibus, castaneo-brunneis. Teleutosporis late ellipticis, 40–55 × 28–35 mmm.; apice obtuse acuminato, saepe rotundato, incrassato, ad 10 mmm., basi rotundato, non saepe attenuato, cellulis similibus; ad septum non constricto: episporio punctato, 3–4 mmm. crasso, castaneo, contentu granuloso, nucleis conspicuis; pedicello deciduo, hyalino, delicato, ad 30 × 8 mmm.; foramine germinis cellulae superioris apicale vel ⅓ infra summum, conspicuo, foramine basali statim v. ⅓ infra septum, conspicuo.

Hab.: In foliis vivis *Celmisiae rigidae* (Kirk) Cockayne. Queenstown, Otago, New Zealand. *G. H. C.*

10. Puccinia Halorrhagidis sp. nov. (Fig. 44.)

0. Spermagoniis epiphyllis, caulicolisque, dispersis, raris, immersis, pallido-flavis.

I. Aecidiis hypophyllis, in superficie foliarum dispersis. Peridiis cupulatis, marginibus erumpentibus, aliquantum incurvis, laceratis, luteo suffusis. Aecidiosporis globosis v. subglobosis, 18–22 mmm.; episporio minute verruculoso, 1 mmm. crasso, hyalino, contentu rubro-luteo.

II. Uredosporis amphigenis, praecipue epiphyllis, raris, rotundis, ad 1 mm. latis, bullatis, pulverulentibus, cinnamomeis, rupta epidermide cinctis et partim tectis. Uredosporis globosis vel subglobosis, 20–25 mmm. latis: episporio raro aculeato, 2 mmm. crasso, cinnamomeo, cum 2–3 foraminibus germinis in circulo aequinoctialis.

III. Soris teleutosporiferis uredosoris immixis et similibus. Teleutosporis ellipticis, incompositis, detorisque, 28–42 × 17–27 mmm.; apice rotundato, raro acuminato, non incrassato, basi rotundato, cellula inferior ferme majore quam superiorem; ad septum constricto; episporio leve, 1·5–2·5 mmm. crasso, pallido-castaneo; pedicello deciduo, hyalino, ad 35 × 8 mmm.; foramine cellulae superioris ferme apicale saepe ⅓ infra summum, conspicuo, foramine basali statim ad ⅔ infra septum, conspicuo, cellulis saepe papillatis.

X. Mesosporis vulgaribus, obovatis, apice acuminato, saepe truncato.

Hab.: In foliis vivis *Halorrhagidis depressae* (A. Cunn.) Walp. et *H. erectae* (Murr.) Schindler. Seatoun, Wellington, New Zealand. *E. H. Atkinson, G. H. C.*

11. Puccinia hectorensis sp. nov. (Fig. 68.)

0. Incognitis.

I. Aecidiis hypophyllis et petiolibus, sparsis v. in catervis irregularibus congestis, raris, pallido-flavis. Peridiis cylindraceis, super folium 1 mm. exstitis, ad 0·5 mm. latis, pallido-flavis, marginibus erectis, laceratis.

Aecidiosporis polygoniis, 30–40 × 20–30 mmm.; episporio pallido-flavo-brunneo, 2 mmm. crasso, dense minuteque verruculoso.

III. Soris teleutosporiferis hypophyllis, ochraceis, raris, circularibus, 1·5 mm. lateris, compactis, diu denso tomento folii tectis. Teleutosporis linearibus oblongis, 100–140 × 20–32 mmm.; apex rustice rotundato, non vel vix incrassato, basi subattenuato, cellula inferiore paullo angustiore quam superiorem, contentu granuloso, pallido-luteo; paullo constricto ad septum; episporio leve, 1·5–2 mmm. crasso, hyalino; pedicello persistente, hyalino, ad 100 × 10 mmm., in sporo se inclinato; foramine germinis superioris cellulae apicale, obscuro, foramine basali statim infra septum, obscuro.

X. Mesosporis vulgaribus. 60–85×16–24 mmm.; apice rustice rotundato.

Hab.: In foliis vivis, petiolibusque *Senecionis Bidwillii* Hook. f. Mount Dennan, Tararua Mountains, New Zealand, 1,200 m. *E. H. Atkinson.*

12. Puccinia Hoheriae sp. nov. (Fig. 41, and Plate 77, fig. 9.)

0. Spermagoniis epiphyllis, sparsis, in raris catervis in maculis pallidis, minutis, immersis, subflavis.

III. Soris teleutosporiferis amphigenis, praecipue hypophyllis, et caulicolis, in foliis raris, in maculis purpureis, sed saepe in incompositis catervis ad 40 mm. longis confertis, in caulis in catervis magnis, incompositis, detorsis, inflatisque ad 50 mm. longis, castaneo-brunneis, pulverulentibus. Teleutosporis ellipticis, non saepe subclavatis, 33–45 × 15–21 mmm.; apice rotundato, non v. leniter incrassato, basi subattenuato v. rotundato, cellulis similibus; ad septum constrictis; episporio minute reticulato, 1·5–2 mmm. crasso, fulvo, contentu vacuolato; pedicello deciduo, hyalino, breve, ad 60 × 7 mmm.; foramine germinis superioris cellulis apicale, conspicuo, foramine basali statim super pedicellum, conspicuo.

Hab.: In foliis vivis, petiolibus, surculisque *Hoheriae populneae* A. Cunn. Karori, Wellington, New Zealand. *R. Waters.*

13. Puccinia inornata sp. nov. (Fig. 36.)

0. Incognitis.

III Soris teleutosporiferis amphigenis, caulicolisque, rotundis v. ellipticis, raris inde confluentibus, ad 1·5 mm. longis, cinnamomeis, pulverulentibus, epidermide rupta cinctis. Teleutosporis ellipticis, 23–35 × 12–16 mmm.; apice rotundato v. rustice acuminato, non incrassato, basi rotundato; cellulis similibus vel inferiore aliquantum angustiore; ad septum constrictis; episporio minute verrucoso, 1·5–2 mmm. crasso, pallido-brunneo; pedicello deciduo, hyalino, saepe tincto, breve, ad 20 × 5 mmm.; foramine germinis superioris cellulae apicale, conspicuo, saepe papillato, foramine basali statim super pedicellum, conspicuo.

Hab.: In foliis vivis, caulibusque *Cardaminidis heterophyllae* (Forst. f.) Schultz. Otago, New Zealand. *W. D. Reid.*

14. Puccinia Kirkii sp. nov. (Fig. 31.)

0, I. Incognitis.

II. Uredosoris amphigenis, raro hypophyllis, cinnamomeis, rotundis, raris, pulverulentibus, 0·5 mm. crassis, epidermide rupta cinctis. Uredosporis ellipticis v. obovatis, 23–29 × 19–21 mmm.; episporio raro rusticeque echinulato, 1–1·5 mmm. crasso, pallido-cinnamomeo, cum 3 raris foraminibus germinis.

III. Soris teleutosporiferis uredosoris immixis. Teleutosporis late ellipticis, 25–33 × 19–22 mmm.; apice rotundato, non incrassato, basi rotundato, raro attenuato, cellulis similibus; leniter constrictis ad septum; episporio leve, 1 mmm. crasso, pallido-brunneo, contentu granuloso; pedicello deciduo, hyalino, fragile, ad 33 × 5 mmm.; foramine germinis superioris cellulae apicale, conspicuo, foramine basali $\frac{2}{3}$ infra septum, conspicuo, cellulis saepe papillatis.

X. Mesosporis raris, obovatis, 27 × 20 mmm.; apice rotundato.

Hab.: In foliis vivis *Rumicis neglecti* T. Kirk et *R. flexuosi* Sol. Otago, New Zealand. *E. H. Atkinson.*

15. **Puccinia kopoti** sp. nov. (Fig. 48.)

0. Spermagoniis amphigenis, sparsis, raris, subflavis.

I. Aecidiis hypophyllis, sparsis, raris, minutis. Peridiis cylindraceis, super superficiem exstitis, marginibus erectis, albis, laceratis. Aecidiosporis polygoniis, 18–24 mmm. crassis; episporio minute denseque verruculoso, hyalino, 2 mmm. crasso, contentu pallido-luteo.

II. Uredosoris hypophyllis, pallido-flavis, ellipticis, 1·5 mm. longis, raris, pulverulentibus, bullatis, epidermide in longitudinem diffindente. Uredosporis obovatis v. ellipticis, 25–35 × 16–20 mmm.; episporio rustice sparseque echinulato, 1·5–2 mmm. crasso, hyalino, contentu sulfureo, cum 3 raris foraminibus germinis.

III. Soris teleutosporiferis amphigenis, raris, rotundis v. ellipticis, 0·25–0·5 mm. latis, bullatis, pulverulentibus, spadicibus, diu tectis ad extremum rupta epidermide cinctis. Teleutosporis ellipticis v. saepe subclavatis, 30–40 × 18–22 mmm.; apice rotundato, vix incrassato necne, basi abrupte attenuato, saepe rotundato, cellula basali ferme angustiore quam superiorem; ad septum leniter constricto; episporio minute denseque verruculoso, 1·5–2 mmm. crasso, castaneo, contentu vacuolato; pedicello hyalino, deciduo, delicato, ad 45 × 5 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali $\frac{1}{2}$ infra septum, conspicuo, papillato.

Hab.: In foliis vivis petiolibusque *Anisotomidis aromaticae* Hook. f. Lake Harris, Otago, New Zealand. *W. D. Reid.*

16. **Puccinia novae-zelandiae** sp. nov. (Fig. 72.)

0. Spermagoniis epiphyllis, sparsis, raris, subflavis.

I. Aecidiis epiphyllis, in raris catervis in maculis decoloratis, rotundis, sparse confertis. Peridiis cylindraeceis, super superficiem folii 1 mm. exstitis, marginibus albis, revolutissimis, profunde incompositeque laciniatis, ad extremum genere *Roestelia* similibus. Aecidiosporis polygoniis, ellipticis v. obovatis, 25–35 × 15–22 mmm.; episporio minute denseque verruculoso, 1·5–2 mmm. crasso, hyalino, contentu flavo.

III. Soris teleutosporiferis hypophyllis, rubro-luteis, rotundis v. ellipticis, raris, pulverulentibusque, ad 0·5 mm. latis, in denso tomento folii profunde immersis. Teleutosporis ellipticis v. elliptico-clavatis, 55–93 × 25–37 mmm.; apice rotundato, non incrassato, basi rotundato, non saepe subattenuato, cellulis ferme similibus; ad septum constricto; episporio leve, 2–3 mmm. crasso, hyalino, contentu flavente, granuloso; pedicello persistente, hyalino, crasso ad 95 × 12 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali statim infra septum, conspicuo.

X. Mesosporis vulgaribus, obovatis v. pyriformibus, 45–55 × 30–37 mmm.; apice rotundato, non incrassato, contentu flavente.

Hab.: In foliis vivis *Oleariae Forsteri* Hook. f. Pencarrow, Wellington, New Zealand. *E. H. Atkinson.*

17. Puccinia Oreomyrrhidis sp. nov. (Fig. 49.)

0. Spermagoniis amphigenis, raris, minutis, subflavis.

III. Soris teleutosporiferis amphigenis, praecipue hypophyllous, et caulicolis, primum raris, rotundis, minutis ad 0·5 mm. latis, et epidermide rupta cinctis, inde confluentibus, pulverulentibusque, ad extremum saepe tota infraficie folii tecta. Teleutosporis ellipticis, raro subclavatis, 31–45 × 17–20 mmm.; apice rotundato, paulum incrassato, 3–3·5 mmm., basi attenuato, cellula basali paulum longiore angustioreque quam superiorem; ad septum constricto; episporio minute sed clare punctato, 1·5–2 mmm. crasso, castaneo, contentu vacuolato; pedicello persistente, hyalino, fragile, ad 80 × 8 mmm.; foramine germinis cellulae superioris apicale, conspicuo, foramine basali $\frac{3}{4}$ infra septum, conspicuo.

X. Mesosporis raris, obovatis v. clavatis, aliquantum truncatis, 22–28 × 15–25 mmm.

Hab.: In foliis vivis *Oreomyrrhidis andicolae* Endl. Hanmer, Canterbury, New Zealand. *W. D. Reid.*

18. Puccinia pedatissima sp. nov. (Fig. 55.)

0. Incognitis.

III. Soris teleutosporiferis hypophyllis, minutis, 0·1–0·25 mm. latis, circularibus, in catervis raris, circularibus, ad 2 mm. latis, solide confertis, compactis, pulvinatis, nudis, ochraceis. Teleutosporis ellipticis, v. breve fusoideis, 40–52 × 14–18 mmm.; apice rustice acuminato, ad 8 mmm. crasso, basi attenuato, cellulis similibus v. cellula basali paullo angustiore, contentu granuloso, nucleis conspicuis; ad septum leniter v. non constrictis; episporio leve, 1–1·5 mmm. crasso, brunneo tincto; pedicello persistente, hyalino, ad 40 × 6 mmm., sporo se inclinato; foramine germinis cellulae superioris apicale, obscuro, foramine basali statim infra septum, obscuro.

X. Mesosporis raris, 25–30 × 12–16 mmm., apice acuminato, incrassatoque.

Hab.: In foliis vivis, petiolibusque *Ourisiae macrophyllae* Hook. Mount Egmont, 1,200 m,, New Zealand. *W. D. Reid, N. R. Foy.*

19. Puccinia pounamu sp. nov. (Fig. 74.)

0. Spermagoniis hypophyllis, sparsis, raris, immersis, subflavis.

III. Soris teleutosporiferis amphigenis, praecipue hypophyllis, in raris catervis in maculis decoloratis, cinctis marginibus flavis confertis, rotundis, minutis, 0·5 mm. latis, pulvinatis, compactis, castaneis, epidermide rupta cinctis. Teleutosporis elliptico-clavatis v. ellipticis 47–65 × 14–29 mmm.: apice rotundato, raro rustice acuminato, incrassato ad 10 mmm., basi attenuato, cellula inferiore angustiore et aliquantum longiore quam superiore; ad septum leniter constricto necne; episporio leve, brunneo fere, hyalino, 2–2·5 mmm. crasso: pedicello persistente, hyalino, crasso ad 50 × 12 mmm.; foramine germinis cellulae superioris apicale, obscuro, foramine basali statim infra septum, obscuro.

Hab.: In foliis vivis *Senecionis southlandici* Cockayne. Otago, New Zealand. *W. D. Reid.*

20. **Puccinia Reidii** sp. nov. (Fig. 37.)

0. Spermagoniis amphigenis, soros praecessis, in maculis decoloratis, raris v. in raris catervis, immersis, subflavis.

III. Soris teleutosporiferis amphigenis, caulicolisque, ellipticis, raris, ad 1 cm. longis, bullatis, pulverulentibus, nigris. diu tectis ad extremum expositis rupta epidermide. Teleutosporis elliptico-ovatis, 32–42 × 15–22 mmm.; apice rotundato, raro acuminato, non incrassato, basi rotundato, cellulis similibus, contentu granuloso; ad septum constrictis; episporio castaneo, clare striato, striis ad axes se inclinatis, crasso 3 mmm.; pedicello deciduo, hyalino, ad 45 × 6 mmm.; foramine germinis superioris cellulae apicale vel saepe ½ infra summum, conspicuo, foramine basali statim infra septum, conspicuo, cellulis ferme papillatis.

Hab.: In foliis, petiolibus, caulibusque *Radiculae* sp. ined. Otago, New Zealand. *W. D. Reid.*

21. **Puccinia tararua** sp. nov. (Fig. 52.)

0. Spermagoniis amphigenis, sparsis, raris, immersis, subflavis.

II. Uredosoris amphigenis, caulicolisque, raris v. in incompositis catervis confertis, ad 2 mm. latis, rotundis, pulverulentibus, cinnamomeis, rupta epidermide cinctis. Uredosporis obovatis v. subglobosis, 20–30 × 18–23 mmm.; episporio rustice sparseque echinulato, crasso 1 mmm., pallido-flavo, cum uno foramine germinis conspicuo.

III. Soris teleutosporiferis amphigenis, caulicolisque, raris, rotundis, ad 1 mm. latis, castaneis, pulvinatis, compactis, rupta epidermide cinctis. Teleutosporis fusiformibus, 50–70 × 10–15 mmm.; apice rustice acuminato v. rotundato, incrassato ad 10 mmm., basi attenuato, ad pedicellum leniter se inclinato, cellulis similibus; leniter ad septum constricto necne; episporio leve, 1 mmm. crasso, pallido-brunneo v. ochraceo, contentu vacuolato; pedicello persistente, hyalino, crasso ad 50 × 10 mmm.; foramine germinis cellulae superioris apicale, obscuro, foramine basali statim infra septum, obscuro.

Hab.: In foliis vivis, caulibusque *Gentianae patulae* Cheesem. Mount Hector, Wellington, New Zealand. *E. H. Atkinson.*

22. **Puccinia tiritea** sp. nov. (Fig. 32.)

0. Spermagoniis epiphyllis, in catervis raris subrotundis, in maculis flavis, minutis, immersis, subflavis.

II. Uredosoris hypophyllis, raris vel in catervis incompositis, non confluentibus, rotundis v. ellipticis, minutis, 0·25–0·5 mm. latis, pulverulentibus, cinnamomeis, epidermide rupta cinctis. Uredosporis obovatis, 25–32 × 22–28 mmm.: episporio raro rusticeque echinulato, 1·5–2 mmm. crasso, cinnamomeo, cum 2–3 raris foraminibus germinis.

III. Soris teleutosporiferis uredosoris similibus immixisque, spadicibus. Teleutosporis late ellipticis, 25–32 × 17–25 mmm.; apice rotundato, non incrassato, basi rotundato, raro attenuato, cellulis similibus; episporio rustice verrucoso, 1·5–2 mmm. crasso, castaneo; pedicello deciduo, hyalino, breve, ad 30 × 7 mmm.; foramine germinis superioris cellulae statim super septum, conspicuo, foramine basali statim infra septum, conspicuo.

Hab.: In foliis vivis *Muehlenbeckiae australis* (Forst. f.) Meissn. et *M. complexae* (A. Cunn.) Meissn. Palmerston North, Wellington, New Zealand. *G. H. C.*

LIST OF WORKS REFERRED TO.

ARTHUR, J. C., 1904. The Aecidium of Maize-rust, *Bot. Gaz.*, vol. 38, p. 64.
—— 1907. *North American Flora*, vol. 7. pt. 2, p. 151. New York.
—— 1910. Cultures of Uredineae, *Mycologia*, vol. 7, p. 228.
—— 1917. Cultures of Uredineae, *Mycologia*, vol. 9, p. 296.
—— 1921. *North American Flora*, vol. 7, pt. 6, p. 436.
ARTHUR, J. C., and FROMME, F. D., 1920. *North American Flora*, vol. 7, pt. 4
ARTHUR, J. C., and KERN, F. D., 1920. *North American Flora*, vol. 7, pt. 5, pp. 352–69.
BARCLAY, A., 1891. On the Life-history of *Puccinia coronata* Cda. var. *himalensis*, *Trans. Linn. Soc. Lond.*, vol. 2, ser. 3, pt. 6, pp. 227–36.
BARY, A. DE, 1865. Neue Untersuchungen ueber Uredineen, insbesondere die Entwickelung der *Puccinia graminis*, Part I, *Monatsber. d. Kon. Akad. der Wiss. Berlin*, p. 15.
BLACKMAN, V. H., 1903. On the Conditions of Teleutospore Germination and of Sporidia Formation in the Uredineae, *New Phytologist*, vol. 2, p. 10.
—— 1904. On the Fertilization, Alternation of Generations, and General Cytology of the Uredineae, *Ann. Bot.*, vol. 18, p. 323.
BOLLEY, H. L., 1898. Einige Bemerkungen ueber die symbiotische Mykoplasma theorie bei dem Getreiderost, *Centralbl. f. Bakt.*, Par. 2, Abt. IV, p. 893.
CARLETON, M. A., 1899. Cereal Rusts of the United States, a Physiological Investigation, *U.S. Dept. Agr. Bull. No. 16.*
CHEESEMAN, T. F., 1906. *Manual of the New Zealand Flora.* Wellington.
CHRISTMAN, A. H., 1905. Sexual Reproduction of the Rusts, *Bot. Gaz.*, vol. 39, p. 267.
—— 1907A. The Nature and Development of the Primary Uredospores, *Trans. Wisconsin Acad. Sci.*, vol. 15, p. 517.
—— 1907B. Alternation of Generations and the Morphology of the Spore-forms in Rusts, *Bot. Gaz.*, vol. 44, p. 87.
ERIKSSON, J., 1894. Ueber die Specialisierung des Parasitismus bei den Getreiderostpilzen, *Ber. Deutsch. Bot. Gaz.*, vol. 12, p. 292.
—— 1897. Vie latente et plasmatique de certaines Urédinées, *Comp. Rend.*, vol. 124, p. 475.
—— 1908. Neue Studien ueber die Spezialisierung der Grasbewohnenden Kronenrostarter, in *Archiv. Botanik.*, vol. 8, No. 3.
ERIKSSON, J., and HENNING, E., 1894. Die Hauptresultate einer neuen Untersuchung ueber die Getreideroste, *Zeitschr. f. Pflanzenkr*, vol. 4, p. 257.
FREEMAN, E. C., and JOHNSON, E. C., 1911. The Rusts of Grain in the United States, *U.S. Dept. Agr. Bull. 216.*
GARRETT, A. O., 1910. *Mycologia*, vol. 2, p. 292.
GROVE, W. B., 1913. *The British Rust Fungi.* Cambridge.
JACKY, E., 1900. Der Chrysanthemum-Rost, *Zeitschr. f. Pflanzenkr.*, vol. 10, p. 132.
JACZEWSKI, A. DE, 1910. Studien ueber das Verhalten des Schwarzrostes des Getreides in Russland, *Zeitschr. f. Pflanzenkr*, vol. 20, p. 321.
JUEL, H. O., 1908. *Sv. Bot. Tidssk.*, vol. 2, p. 169.
KLEBAHN, H., 1891. Kulturversuche mit heterocischen Uredineen, *Zeitschr. f. Pflanzenkr.*, vol. 4, p. 4.
LIRO, J. I., 1906. Kulturversuche mit finnischen Rostpilzen Part 1, *Acta Soc. pro Fauna et Flora Fennica*, vol. 29, No. 6.
MCALPINE, D., 1902. *Fungus Diseases of Stone-fruit Trees and their Treatment*, p. 23.
—— 1904. Note on the Arrangement of the Teleutospores of *Puccinia Pruni* Pers., *Annals Myc.*, vol. 2, p. 348.
—— 1906. *The Rusts of Australia.* Melbourne.
MUELLER, F., 1901. *Beihefte. Bot. Centralb.*, vol. 10, p. 201.
NIELSEN, P., 1875. De for Landbruget Farligst. Rustarter og Midlere Imad den *Ugeskr. for Landmaend.*, vol. 4, ser. 9, pp. 549–56.
OLIVE, E. W., 1908. Sexual Cell Fusions and Vegetative Nuclear Divisions in the Rusts, *Ann. Bot.*, vol. 22, p. 331.
STAKMAN, E. C, and PIEMEISEL, F. J., 1917. Biologic Forms of *Puccinia graminis* on Cereals and Grasses, *Jour. Agr. Res.*, vol. 10, pp. 429–95.
STAKMAN, E. C.; PIEMEISEL, F J.; and LEVINE, M. N., 1918. Plasticity of Biologic Forms of *Puccinia graminis*, *ibid.*, vol. 15, pp. 221–49.
SYDOW, H. and P.. 1902. *Monographia Uredinarum*, vol. 1, p. 49.
—— 1910. *Monographia Uredinarum*, vol. 2, pp. 131–32.
TRANZSCHEL, W. A., 1904. Ueber die Moeglichkeit, die Biologie wirtswechselnder Rostpilze auf Grund morphologischer Merkmale vorauszusehen, *Trav. de la Soc. Imp. de Nat. de St. Petersbourg*, vol. 35, p. 286.
WARD, H. M., 1903. On the History of *Uredo dispersa* Erikss., and the "Mycoplasm" hypothesis, *Phil. Trans. Roy. Soc.*, vol. 196, B., p. 29.
—— 1905. Recent Researches on the Parasitism of Fungi, *Ann. Bot.*, vol. 29, p. 18.

COMBINED HOST AND FUNGUS INDEX.

All synonyms are in italics. Page numbers of synonyms and of incidental references are in ordinary type; those under which are to be found descriptions of species, genera, or families, or hosts of these species, are in italics; those under which are to be found Latin diagnoses of new species are in brackets. An asterisk preceding a page number indicates that an illustration of the species in question will be found on that page.

This index gives only those synonyms that have been used in recent publications, or are some guide to the species in question.

DESCRIPTION OF PLATE 77.

FIG. 1.—*Uromyces Discariae* sp. nov. Cylindrical aecidia from *Discaria toumatou* Raoul. × 2 5.

FIG. 2.—*Aecidium otagense* Lindsay. Showing distortion of the host, *Clematis indivisa* Willd., caused by the perennial mycelium. Half nat. size.

FIG. 3.—*Uromyces Betae* Lev. Bullate uredo- and teleuto-sori, on *Beta vulgaris* L. The white outline round the sorus is the ruptured epidermis. × 2·5.

FIG. 4.—*Puccinia graminis* Pers. Linear naked teleutosori on *Triticum vulgare* Vill. × 2 5.

FIG. 5.—*Puccinia clavata* Syd. Cylindrical erumpent aecidia surrounding the immersed spermogones; on *Clematis hexasepala* DC. × 2 5.

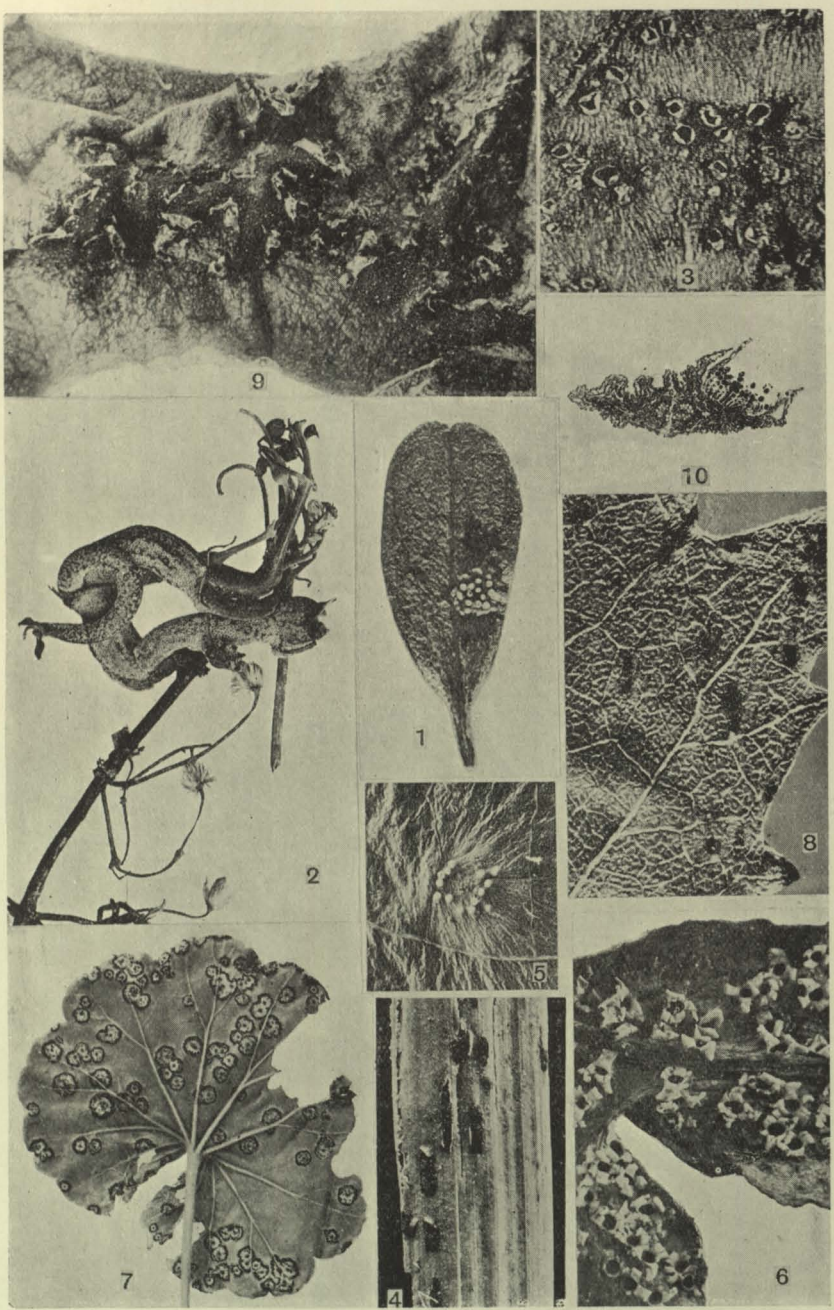
FIG. 6.—*Puccinia Pruni-spinosae* Pers. Widely expanded aecidia on *Anemone*. × 2 5.

FIG. 7.—*Puccinia granularis* Kalch. et Cke. Circinnate teleutosori surrounding the bullate uredosori, on *Pelargonium zonale* L'Herit. Half nat. size.

FIG. 8.—*Puccinia Plagianthi* McAlp. Scattered, circular teleutosori on *Plagianthus betulinus* A. Cunn. × 2 5.

FIG. 9.—*Puccinia Hoheriae* sp. nov. Confluent pulverulent teleutosori on *Hoheria populnea* A. Cunn. Note leaf-distortion. × 2 5.

FIG. 10.—*Puccinia Hydrocotyles* Cke. Aecidia on *Hydrocotyle novae-zelandiae* DC. Microphotograph of a section. × 30.



[*Photos by E. Bruce Levy.*